

**THE ROLE OF SOCIAL SUPPORT IN WEIGHT CHANGES DURING FRESHMAN
YEAR OF COLLEGE**

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University of Pittsburgh, 2013

Over 50% of college students are overweight or obese, and there is a high incidence of weight gain during the college years. Social support has been linked with weight loss and improvements in diet and exercise in the general population. As social support changes in college, there may be a relationship between social support and weight or weight related behaviors during freshman year of college. **PURPOSE:** This investigation aimed to explore the relationships between global or behavior-specific social support and BMI, exercise habits, and dietary habits in freshman college students. A secondary aim was to determine whether these relationships differed by gender. **METHODS:** Fifty male and 50 female college freshmen ($BMI = 24.0 \pm 3.3$ kg/m²) aged 18-20 completed questionnaires regarding pre-college height and weight, global, diet, and exercise-specific social support, exercise and dietary habits, and completed assessments of height, weight and body composition. **RESULTS:** Change in BMI over the first semester was not significantly associated with global, exercise-specific, or diet-specific social support. Friend support for healthy eating behaviors was significantly associated with current BMI ($\rho =$

.29, $p = .004$). Exercise (min/week) was significantly associated with friend support for exercise ($\rho = .35$, $p < .001$). While no clear relationship between social support and dietary habits existed, global social support was associated with sweetened beverage consumption, snacking frequency, and alcohol consumption. In overweight and obese subjects, higher global social support was associated with lower increases in BMI over the first five months of freshman year ($r = -.40$, $p = .027$). **Conclusions:** Increasing social support for exercise and healthy eating behaviors may benefit the lifestyle behaviors of college freshmen, though longitudinal studies are required to determine causality. Moreover, relationships between social support and behaviors may be particularly interesting in overweight and obese individuals.

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1.0 REVIEW OF THE LITERATURE

Over two-thirds of the U.S. population is overweight or obese,¹ defined as having a body mass index (BMI) $\geq 25.0 \text{ kg/m}^2$ and $\geq 30.0 \text{ kg/m}^2$ respectively.² These individuals have an increased risk of all-cause mortality,³ cardiovascular disease,⁴⁻⁶ diabetes,^{7,8} and certain cancers.^{7,9,10} While behavioral weight loss programs typically produce significant weight loss over 6 months, long-term weight loss maintenance remains elusive as only 20% of successful losers are able to maintain this weight loss for at least one year.^{11,12} As obesity rates continue to rise, it is critical to identify ways to reach populations at risk of weight gain and induce sustainable lifestyle changes for weight loss and prevention of weight gain.

Weight changes are a direct result of disturbances to energy balance, the balance of energy intake and energy expenditure. Energy intake is dependent primarily on calories consumed, while energy expenditure is comprised of resting metabolic needs, the thermic effect of food, and physical activity, with physical activity being the most variable component. When energy expenditure exceeds energy intake, the result is weight loss. Likewise, when energy intake exceeds energy expenditure, the result is weight gain. Current recommendations for weight loss include a low calorie, low fat diet,¹² and 250-300 minutes/week of aerobic physical activity.¹³ Therefore, any efforts to combat overweight and obesity must ultimately decrease energy intake, increase physical activity, or both.

1.1 COLLEGE STUDENTS

Over half of young adults aged 20-39 years are overweight (body mass index (BMI) ≥ 25 kg/m²) or obese (BMI ≥ 30 kg/m²).² The college years represent a critical point in determining weight trajectory^{14,15} and weight gain in one's early twenties has been shown to predict continued weight gain in adulthood.^{16,17} College age students gain weight more rapidly than other age groups¹⁴ and nationally representative survey data demonstrates a incidence of obesity during the college years.¹⁸ Studies estimate that individuals 18-25 years old gain an average 1-2 lbs. (0.45-0.9kg) per year.^{19,20} Therefore, the college years are a pivotal time for determining current and future weight changes.

As previously discussed, breadth of scientific research has linked overweight and obesity to increased risk of all-cause mortality,³ cardiovascular disease,⁴⁻⁶ diabetes,^{7,8} and cancer.^{7,9,10} Relevant to this investigation, weight gain during emergent adulthood (18-25 years old) is associated with adverse changes in many risk factors for cardiovascular disease including both systolic and diastolic blood pressure, HDL-C, LDL-C, triglycerides and blood glucose.¹⁷ College is a particularly relevant arena for behavioral interventions as weight gain during this stage is related to the development of sedentary behaviors and poor dietary habits,²¹ leading to continued weight gain and further increases in disease risk in adulthood.¹⁷ Intervening during college, these risks can be avoided by helping overweight students successfully lose weight, or normal weight students prevent weight gain.

Not all students gain weight when entering college, but it appears that certain groups of students are susceptible to significant weight gain during their freshman year of college.²²⁻²⁵ Average freshman weight gain reported in the literature has ranges from 0.7 kg²⁶ to 3.1 kg,²⁷

with a wide variability in weight change over the course of freshman year.²² However, the subset that does gain weight, gains an average 3.1-3.4 kg during freshman year. Students often gain 2.3-3.2 kg during the first semester, and by the end of sophomore year, males and females are often 4.3 and 4.2 kg heavier than when they entered college, respectively.¹⁶ Thus, it is important to identify factors contributing to diet and exercise behaviors in the college population, which ultimately result in weight loss or gain. Future interventions can then manipulate these factors to achieve and sustain healthy weight in college students, and thereby reduce morbidity and improve quality of life into middle and late adulthood.

1.1.1 Physical Activity in the Transition to College

Weight gain in college may be due in part to a decrease in physical activity. Previous studies have found that 40-50% of college students do not meet ACSM's physical activity recommendations for general health,²⁸ and at least one study has reported 70% of college students are not meeting activity recommendations.²⁹ These rates reflect a general shift toward a more sedentary lifestyle during the transition from high school to college.

A recent study assessed anthropometric, fitness, dietary and physical activity characteristics of 54 college women upon entering college, and again 5 months later.²⁶ Despite decreased caloric intake from baseline to follow-up, participants gained weight between these time points. This discrepancy was explained by decreases in occupational, sport, and total physical activity. The Freshman Health Study assessed college students in August and December of their freshman year on anthropometric, dietary and exercise measures.²⁴ Students who gained $\geq 5\%$ of their initial body weight during the semester were significantly more likely to report less physical activity in the first three months of college than they had during high

school. Thus, the decrease in activity seen from high school to college appears to be related to freshman weight gain. However, the factors responsible for this decrease in activity have not been clearly defined.

Interventions to increase physical activity in college students have been largely unsuccessful.³⁰⁻³³ Further study is needed to determine factors associated with increases or decreases in physical activity during this transition. Such results can inform efforts to increase, or to prevent a decrease in the physical activity of college students.

1.1.2 Dietary Changes in the Transition to College

The eating landscape changes dramatically for freshmen college students. On campus residents are faced with buffet choices at dining halls, and social events as well as readily available alcohol. Students may have greater control of their diet, as parents or school cafeterias no longer determine their meals. However, studies of dietary changes in college students have provided inconclusive results.^{22-26,34-36} While previous studies have all observed an average weight gain during the specified time during college, many report decreased caloric intake over the same time frame.^{24,26,37} This could be due to inaccuracies in the self-report measures (i.e. Food Frequency Questionnaire) used to collect this data.

Efforts have been made to characterize the diet-related factors associated with weight gain in college. The Freshmen Health Study found a positive relationship between eating breakfast and weight gain, which was likely an artifact of the relationship between eating breakfast and access to all-you-can-eat dining halls.²⁴ This is supported by a recent study that found students living on campus gained significantly more weight than their off campus peers

(1.65kg vs. 0.13kg).¹⁵ Other dietary changes seen in college include increased alcohol intake,^{24,26,35} decreased fruit and vegetable consumption,²³ and opportunistic eating.²²

1.2 SOCIAL SUPPORT

Students leaving home for college for the first time may experience a loss of social support as they are removed from their support networks.³⁸ As social support has beneficial effects on weight and related behaviors, it follows that decreased social support could influence body weight changes during freshman year of college.

Social support has been defined as “the social resources that persons perceive to be available or that are actually provided to them by nonprofessionals in the context of both formal support groups and informal helping relationships.”³⁹ Family, friends, church groups and coworkers can all contribute to one’s actions and decision making by providing positive or negative social support for various behaviors.⁴⁰ Such support can be emotional, instrumental tangible, informational, or as feedback and appraisal. Social support is highly relevant to human health as it is associated with improved quality of life,⁴¹ reduced mortality⁴² and greater participation in health related behaviors such as smoking and exercise.⁴³⁻⁴⁸

The impact of social support on weight loss and management is well documented.^{40,46,49-52} Correlational research supports a relationship between perceived social support for exercise from friends and greater exercise participation.^{44,53} Previous studies engaging participants’ natural social networks found improved physical activity and weight loss outcomes associated with greater support from participants’ spouses,⁴⁵ parents,⁵⁴ friends,^{44,46} and family.⁴⁴ Furthermore, Hindle and colleagues interviewed participants who had maintained a 10% weight

loss for at least one year, and reported that successful participants listed finding encouragement from family and friends to be among the most important contributors to their success.⁴⁹ Mobilization of one's natural support network for diet and exercise behaviors was associated with weight loss in a recent systematic review of effective intervention components.⁵⁵ Interestingly, the authors found much stronger evidence for the efficacy of natural social networks to provide social support than for support from health professionals or interventionists. This finding agrees with previous research suggesting that support from family and friends is more effective for increasing exercise than support from professionals.^{46,52} Harnessing the support of natural social networks may thus be an effective way to reach the college population.

1.3 THEORETICAL RATIONALE

Social support has been an important component of weight loss interventions in the broader population.^{40,46,51,55} This may be especially important for the socially active college community. Figures 1a and 1b illustrate two theoretical pathways by which social support may influence weight change during college. First, support from peers specific to exercise and dietary behaviors may influence physical activity and caloric intake through changes in social dietary and activity norms, or loneliness, depression, and self-esteem.

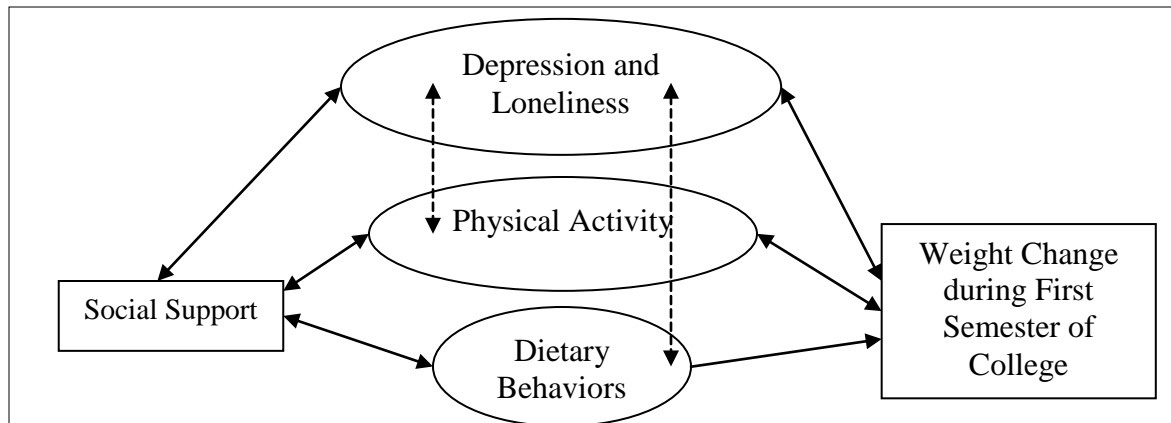


Figure 1a: Theoretical Pathway 1

Alternatively, it may be that the type of social support is less important than the degree to which a student perceives any type of social support. Social support in college has been associated with decreased stress,⁵⁶ improved academic performance,⁵⁶ higher life satisfaction,⁵⁷ and lower depressive symptoms.⁵⁸ It could be that decreases in global support (general social support, not specific to behaviors such as diet and exercise) result in loneliness, boredom, decreased self-esteem and stress, which in turn lead to decreased physical activity and increased caloric intake. Conversely, increased social support for peers may have a negative influence on eating and exercise behavior if these peers do not espouse healthy lifestyles. Therefore, the purpose of this study is to examine the relationships between global and behavior specific social support and weight change in college freshmen. Global support will be referred to as two constructs from this point forward. First, global support as measured by the Inventory of Socially Supportive Behaviors, which captures specific instances of received social support will be abbreviated as “Global-Received”, second, global support as measured by the Social Provisions Scale, which captures perceived social support will be abbreviated as “Global-Perceived”.

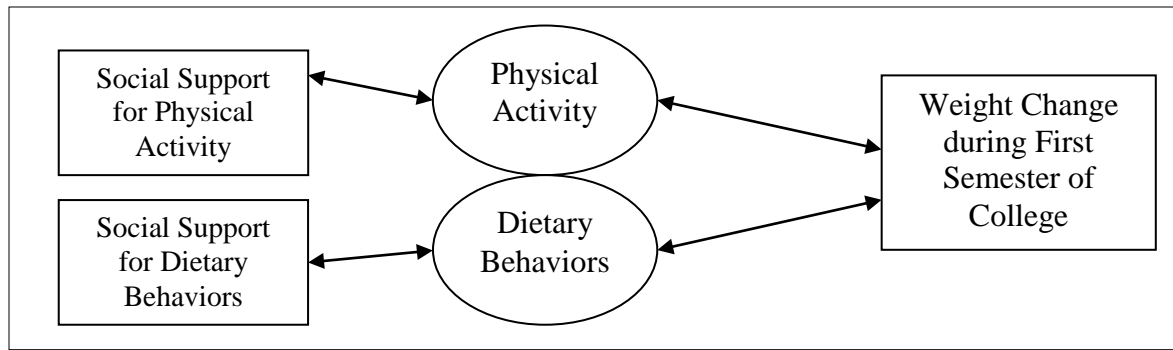


Figure 1b: Theoretical Pathway 2

1.4 SPECIFIC AIMS

1) To examine the association between social support and BMI (measured as current BMI and change in BMI during the first semester) in college freshmen.

1a) To examine the relationship between global social support (perceived and received support) and BMI in college freshmen.

1b) To examine the relationship between social support for physical activity and BMI in college freshmen.

1c) To examine the relationship between social support for healthy dietary behaviors and BMI in college freshmen.

2) To examine the association between social support and physical activity in college freshmen.

1a) To examine the relationship between global social support and current physical activity in college freshmen.

- 1b) To examine the relationship between social support for physical activity and current physical activity in college freshmen.
- 3) To examine the association between social support and dietary behaviors in college freshmen.
 - 1a) To examine the relationship between global social support and engagement in healthy dietary behaviors in college freshmen.
 - 1b) To examine the relationship between social support for healthy dietary behaviors and engagement in those behaviors in college freshmen.
- 4) To determine if there are significant differences in social support among those who gained, lost, and maintained weight since beginning college.

1.5 HYPOTHESES

- 1) There will be a significant negative association between social support and BMI (measured as current BMI and change in BMI during the first semester) in college freshmen.
 - 1a) There will be a significant negative association between global social support and BMI in college freshmen.
 - 1b) There will be a significant negative association between social support for physical activity and BMI in college freshmen.
 - 1c) There will be a significant negative association between social support for healthy dietary behaviors and BMI in college freshmen.
- 2) There will be a significant positive association between social support and physical activity in college freshmen.

- 2a) There will be a significant positive association between global social support and current physical activity in college freshmen.
- 2b) There will be a significant positive association between social support for physical activity and current physical activity in college freshmen.
- 3) There will be a significant positive association between social support and healthy dietary behaviors in college freshmen.
 - 3a) There will be a significant positive association between global social support and current healthy dietary behaviors in college freshmen.
 - 3b) There will be a significant positive association between social support for healthy dietary behaviors and engagement in those behaviors in college freshmen.
- 4) Those who gained weight since beginning college will report significantly lower social support than those who maintained or lost weight.

1.6 SIGNIFICANCE

Overweight and obesity have reached epidemic rates in the United States, causing significant health problems and decrements to quality of life. Evidence suggests that students in their first year of college are particularly vulnerable to maladaptive lifestyle changes, particularly dietary and activity habits, resulting in the potential for significant weight gain during this period. These changes have implications beyond the immediate weight gain. Left unchecked, a consistent positive energy balance due to these new dietary and physical activity patterns can lead to a creeping weight gain that becomes much larger over time.⁵⁹ Thus, it is critical that college students develop positive dietary and exercise habits during the transition to college.

Efforts to prevent or reverse weight gain during college must be informed by factors associated with changes in diet, physical activity and weight during this time. There is evidence to support a decrease in social support during the first year of college, yet the relationship between social support and weight during this time has received little attention. This study is proposed to address the gaps in the literature regarding whether social support during freshman year of college is related to weight change, and lifestyle behaviors associated with weight. We hypothesize that social support will be negatively associated with weight change, and that support specific to diet and exercise behaviors will have the greatest effect. A significant negative relationship between social support and weight would justify future randomized controlled trials for weight loss interventions with a social support treatment condition in freshman college students.

2.0 REVIEW OF THE LITERATURE

2.1 INTRODUCTION

Overweight and obesity are a major health crisis in the United States, affecting over two-thirds of the population.^{1,2} This excess weight has demonstrated a linear relationship with all-cause mortality,³ due primarily to increased risk of cardiovascular disease and some cancers.^{4,6,9,17} There is strong evidence to suggest that significant weight gain occurs during freshman year of college.^{15,16,24-26,60-62} Therefore, it is important to determine the factors associated with weight gain in these individuals to inform prevention strategies. Social support is one factor known to influence diet and exercise behaviors and body weight. As individuals transition from high school they often experience a shift in their support networks, the relationship between social support and weight change is of particular interest in this population. This study examined the relationship between social support and weight change and weight-related behaviors in college freshmen.

2.2 OBESITY

Obesity is a major health concern in the United States. Data from the most recent National Health and Nutrition Examination Survey (NHANES) places the obesity rate at 35.7% of the

United States population aged 20 and over.⁶³ NHANES is a series of cross-sectional health surveys conducted by the Centers for Disease Control and Prevention. Each survey draws a nationally representative sample, drawing proportionally from both genders and across racial and ethnic groups. From this data, it appears that adults are continuously gaining weight gradually as they age as the rate of obesity increases from 32.6% of individuals 20-39 years old to 36.6% of those 40-59 years old, and 39.6% in those 60 years or older.⁶⁴ The mean BMI for adults in the United States is 28.7, making overweight synonymous with ‘average’.⁶⁴

Continuous surveys beginning in 1999 have enabled examination of trends in overweight and obesity.⁶⁴ A significant increase in overall obesity rates occurred between 1999 and 2008-2010; however, the rates of increase do appear to be slowing or coming to a stop. Unfortunately, there is no evidence to suggest decreased rates of overweight or obesity in any demographic group, despite widespread national efforts.^{63,64}

The problem may only get worse. Data from the Behavioral Risk Factor Surveillance System was used to project overweight and obesity rates over the next 20 years.⁶⁵ A complex logistic regression model was created, factoring in contributors to overweight and obesity such as prices of fast food, various healthy or unhealthy grocery items, employment rates, and growth of restaurant establishments among other factors. The model predicted a non-linear increase resulting in a 41% obesity rate by the year 2030. This increase is projected to cost an extra 549.5 billion dollars in medical expenses above the projected cost were the current rate to remain stable. Clearly, there is a need to intervene at critical time points, to prevent further increases in obesity.

2.3 COLLEGE FRESHMEN

2.3.1 Weight Change in College Freshmen

The ‘Freshman 15’ has been popularized by the media as a common danger of leaving home for college.⁶⁶ While 15 lbs (6.8 kg) may paint an exaggerated picture of average weight gain during freshman year, the term is a product of a real phenomenon. Estimates of the average magnitude of this weight gain have ranged from 0.7²⁶ to 3.1 kg,^{27,67} with the majority of studies reporting significant weight gain.^{15,25} The behaviors responsible for this weight gain are unlikely to stop abruptly after freshman year, and weight gain often continues throughout college.³⁶

A recent meta-analysis of weight change during freshman year pooled subjects across 24 studies (n=3,401) and found a mean weight gain of 3.86 lbs (1.75 kg).²⁵ Mean weight gain varied widely across individual studies. Economos et al.⁶⁸ compared self-reported weight before leaving for college to objective measurement in April of freshman year. Males and females gained an average 2.27 kg and 2.5 kg respectively. Similar results have been found using only objectively measured weight during the summer before starting school and again at each semester’s end.⁶⁷ In addition to a 3.0 kg average weight gain, students had significant increases in BMI, waist circumference, hip circumference, waist to hip ratio, and percent body fat. These findings counter the possibility that weight gain is primarily due to natural growth or added lean mass. In fact, evidence suggests that many students add significant body fat while simultaneously losing lean mass in the first semester of college alone.⁶⁹ Pullman and colleagues measured body composition using bioelectrical impedance analysis (BIA) during the first and final weeks of the fall semester, which spanned 16 weeks. Body fat increased from 30.1% at baseline to 32.2% 16 weeks later.

Focus on average weight gain may obscure a larger problem. Weight change in first year college students varies widely among individuals.²² Using objectively measured weight at four time points over the course of freshman year, Finlayson et al. found changes ranging from -7.2 kg to +11.6 kg three months into freshman year. By the end of the second semester, the range was -14.7 kg to +14.2 kg. Given only the average weight change (+0.83 kg) it would be difficult to appreciate the magnitude of the problem. This variability appears to grow throughout college, with one study finding that students ranged from 13.2 kg lighter to 20.9 kg heavier after four years.³⁶

These findings have been widely replicated.^{14,26,37,60,61,68} Anderson and colleagues¹⁴ weighed 135 students in September and December of their freshman year. While the average weight gain was modest, a quarter of the participants gained ≥ 2.3 kg in those months, and the proportion of students classified as overweight or obese increased by 11%. Another study invited students who had participated in a health assessment in September to complete a follow-up measurement in April of freshman year.⁶¹ The group as a whole gained an average 1.3 kg, and those who gained weight gained an average 3.1 kg. The smaller magnitude of weight change in this study may be attributable to selection bias as those choosing to participate in the initial health screening as well as the follow up could be more health conscious than those that did not participate.

Perhaps more concerning is the evidence that the majority of students are gaining weight, while the subset that loses weight conceals these gains in the means.^{37,60,68} Jung et al.³⁷ weighed college freshmen at the beginning of their first semester and again 12 months later. The mean weight gain was 1.4 ± 3.8 kg (3.08 ± 8.35 lbs). Those that gained weight represented 66% of the sample, and the average weight gain in this group was 3.43 ± 2.73 kg (7.54 ± 6.01 lbs). This was

accompanied by a significant increase in percent body fat. Similar results were found in a study of 336 freshman women.⁶⁰ Sixty-three percent gained weight, and those that did gained an average 3.32 kg. A more extreme example found weight gain in 80% of a sample of 396 freshmen.⁶⁸ Those individuals gained an average 3.54 kg over 9 months. These results present a consensus that a large subset of college freshmen gain weight during their first year, and that this subset is at risk of large and somewhat rapid weight gain.

2.3.2 Factors Associated with Weight Change in College Freshmen

Changes in body weight are a result of a disturbance to energy balance, or the balance between caloric intake and caloric expenditure.⁷⁰ In theory, when energy intake from caloric consumption matches energy expenditure through resting metabolism, thermic effect of food, and physical activity, body weight will remain constant. Therefore, weight gain must ultimately result from an energy surplus caused by an increase in caloric intake, a decrease in energy expenditure, or a combination of the two. Because resting metabolism and the thermic effect of food are relatively constant, decreases in energy expenditure are due in most cases to decreased physical activity. Thus, the factors associated with weight changes in college freshmen must ultimately be associated with changes in dietary intake and physical activity.

2.3.2.1 Physical Activity in College Freshmen

The transition from high school to college is frequently accompanied by marked decreases in physical activity.^{23,24,35,37,67,71-73} Wengreen and colleagues²⁴ found a marked decrease in vigorous physical activity from the last 6 months of high school to the end of the first semester of college. At baseline, approximately 45% of the sample reported engaging in vigorous physical activity on

most days of the week. At the end of the first semester, 23% of those who did not gain weight reported vigorous activity on most days of the week and only 12.5% of those who gained $\geq 5\%$ of their initial body weight reported this level of activity. The majority of students (60.7%) reported engaging in less physical activity at the end of first semester freshman year than they had in the last 6 months of high school.

A study of 101 freshman women calculated MET hours/week at baseline and again at the end of freshman year, based on the Godin Leisure Time Questionnaire.³⁷ A MET, or Metabolic Equivalent of Task, is an estimate of the ratio of the metabolic rate during a given activity to resting metabolism, defined as $3.5 \text{ mlO}_2 \text{ kg}^{-1} \text{ min}^{-1}$. While little change in energy expenditure through physical activity was found over time in those that did not gain weight, MET hrs/wk decreased from 21.5 at the beginning of freshmen year to 16.1 by the end of the year.

Furthermore, the majority of college students are not meeting the current guidelines for physical activity.^{29,74} A survey of 963 undergraduates found that over 50% were sedentary or exercised on an irregular and sporadic basis.⁷⁵ Bray and colleagues⁷¹ compared physical activity during the first semester of college to activity during the 8 months prior using the Godin Leisure Time Questionnaire. Vigorous intensity physical activity decreased significantly, while there was no significant change in moderate intensity physical activity. In addition, students who lived with their parents and commuted were significantly less likely to become insufficiently active than those who lived on campus. This suggests that changes in physical activity are not simply a product of beginning a degree, but are related to the lifestyle changes associated with moving away from home and entering the campus environment.

College students are conscious of this decrease in activity, and have cited several contributing factors in focus groups.³⁵ Both males and females reported lack of time due to work

and classes as a barrier to exercise. Additionally, both genders frequently mentioned the transition to college and stress of relationships as contributors to decreased physical activity. Some students felt that they needed to focus on developing new relationships and adjust to the new workload before considering adding exercise to their routine. Male students often listed a lack of personal motivation for exercise as a major barrier. While many students saw the university fitness center as a facilitator of exercise, many female students felt intimidated by what they perceived as predominantly male crowds, especially on resistance training equipment.

Predictably, decreased physical activity in freshman year is associated with weight gain during that year. The Freshman Health Study asked students whether they were currently participating in more, less, or the same amount of physical activity as they were during the final six months of high school.²⁴ Those that gained $\geq 5\%$ body weight during their first semester of college were significantly more likely to report decreased physical activity since high school. Similarly, Jung and colleagues³⁷ found a trend toward decreased physical activity in those who gained weight (precollege physical activity = 21.5 METhrs/week vs. second semester physical activity = 16.1 METhrs/week), but no significant change in the physical activity of those who maintained or lost weight (precollege physical activity = 24.6 METhrs/week vs. second semester physical activity = 23.2 METhrs/week). There was a significant difference in the absolute physical activity level between weight gainers and weight losers. Some evidence suggests that lack of physical activity is the primary factor predicting weight gain. One study of freshman males found an average 3.0 kg weight gain and significant increases in BMI and both waist and hip circumference measures despite a constant caloric intake between measurements.⁶⁷ Caloric intake was measured using a multiple pass 24-hour recall, and could thus have been inaccurate due to memory bias, or differences in consumption pattern on the days assessed. This study

found a significant decrease in percentage of students participating in “fast” physical activity from approximately 80% of subjects in summer to 40% of subjects after two semesters of college, to which they attributed their results. It is possible however, that individual variations in caloric intake were obscured by the average, or that error due to self-reported intake influenced the results.

2.3.2.2 Dietary Behaviors in College Freshmen

Unhealthy eating has emerged as an independent risk factor for weight gain during freshman year.⁷⁶ Pliner and Saunders created an unhealthy eating index based on consumption of foods high in fat, sugar, and calories, as well as omission of fruits and vegetables. Increases in unhealthy eating scores predicted increases in BMI from October to March of freshman year. Specifically, when entered into a regression model to predict changes in BMI along with dormitory vs. off-campus residence and restrained eating, healthy eating index scores explained 23% of the change in BMI from October to March. Additional factor analysis revealed decreased fruit and vegetable intake as a significant independent predictor of change in BMI. Attempts to quantify increases in caloric intake have yielded mixed results.

Using 3-day diet recalls, Hajhosseini et al.⁶⁹ observed a 55-calorie per day increase over the first 16 weeks of freshman year, which did not reach statistical significance. This increase was not sufficient to explain the average 1.4 kg increase observed from baseline to follow-up. Some studies have even found decreases in caloric intake during freshman year, despite concurrent weight gains.^{26,37} Butler et al.²⁶ administered block food frequency questionnaires at the beginning of freshman year, and again 20 weeks later. Participants reported their daily intake of an extensive list of commonly eaten foods and food categories, from which daily energy intake was estimated. Interestingly, total caloric intake decreased significantly from 2207 ± 878

kcal/day at baseline, to 1857 ± 680 kcal/day 20 weeks later. Despite a reported 350-kcal/day decrease, mean body weight increased by 1.59 lbs. and reached statistical significance. While this magnitude of weight gain may not be clinically significant, a decrease in daily energy intake of this magnitude should result in weight loss of approximately 2 lbs. if energy expenditure remained constant. Furthermore, Jung et al.³⁷ found no significant difference in caloric intake between those who gained weight (approximately 2,180 kcal/d at baseline; 1,860 kcal/d at week 52) vs. those who lost weight (approximately 2,090 kcal/d at baseline; 1900 kcal/d at week 52), and caloric intake decreased slightly in both groups. These results could be due to decreased physical activity, or the calorie estimates could be inaccurate. Inaccuracies could result recall errors or atypical intake when using dietary recall, and the response set biases and imprecise portion estimates when using food frequency questionnaires for quantification of diet.^{77,78}

Given the difficulty of accurately assessing caloric intake, changes in dietary behaviors may provide more insight into the role of energy intake in freshman weight gain. Previous studies have examined dormitory residence,^{23,37,73,76} buffet-style meals,²⁷ dietary restraint,^{22,60,76,79-81} fruit and vegetable intake, alcohol intake, and meal patterns in relation to weight changes.

The proposed link between dormitory residency and weight gain may be related to access to all-you-can-eat dining halls. Kapinos et al.⁷³ found that female students assigned to dorms with on-site dining halls gained .85 kg more over the course of freshman year than peers in dorms without dining halls. Male students living in dormitories with on-site dining halls also reported consuming 0.22 more meals and .38 more snacks each day. The relationship between

snacking and weight gain is supported by findings that increased snacking contributes to greater daily energy intake in overweight and obese individuals.⁸²

Evidence suggests that college students decrease their fruit and vegetable intake, while increasing their alcohol intake during freshman year. Kasperek and colleagues²³ administered a short form FFQ during the third week of freshman year, and again at the end of the spring semester. Chi-square analyses revealed that significantly fewer students were meeting the criteria for adequate intake of fruits and vegetables at the spring follow-up assessment ($\chi^2=4.49$, $p=.034$). Another study found fruit and vegetable intake to be inadequate (based of the USDA recommendation for 5 servings/day) upon college entry, and decreased from 2.3 servings/day to 1.96 servings/day over 5 months ($p=.01$).²⁶ Decreased fruit and vegetable intake was a significant predictor of weight gain in a sample of 396 freshmen given health behavior surveys at the beginning and end of freshman year.⁶⁸ When entered into a regression model including other health behaviors and life stressors, lower fruit and vegetable intake was one of two significant predictors with a $\beta = -2.066$ ($p=.015$).

Freshmen cite alcohol as a contributor to weight gain, due to overconsumption with friends and unhealthy food choices while under the influence.³⁵ Indeed, alcohol consumption increases during freshman year of college,^{23,26} along with binge drinking behaviors.⁶⁷ Increased alcohol consumption has been associated with weight gain in college men.⁶⁸ However, Kasperek et al. found no relationship between alcohol consumption over the previous 30 days and weight changes.²³

Dietary restraint, or the tendency to consciously restrict one's food intake, has also been associated with weight gain during college.^{76,80,81} Women with higher dietary restraint scores appear to be at greater risk for gaining weight during freshman year.⁸¹ Provenchar et al. found

that freshmen women who gained 15 lbs. or more had significantly higher scores on dietary restraint ($t=-3.05$; $p<.01$), and total EDI (Eating Disorder Inventory) ($t=-2.30$; $p<.05$) than those who did not experience this weight gain. One study found that campus residency was only associated with BMI changes in students with high dietary restraint scores.⁷⁶ This seeming paradox is likely a result of high levels of disinhibition that often accompany dietary restraint.⁸³⁻

⁸⁶ Faced with a buffet-style dining hall, a slip from rigid dieting can lead to disinhibition and overindulgence. However, studies on dietary restraint and weight gain in college are not all in agreement. A longitudinal study in college freshmen found that neither dietary restraint, nor disinhibition predicted weight change over the first 4 or 8 months of college.⁸⁰ It has been suggested that increased dietary restraint scores may serve as a proxy for vulnerability to weight gain, rather than directly resulting in overconsumption and excess weight.⁸⁷ Those with higher levels of restraint may eat more in response to relatively minor stressors, of which there are plenty during freshman year.

It is apparent that dietary changes occur as students transition from high school to college; however, it has been difficult to categorize and quantify these changes. While there is no sound evidence for increased caloric intake during this transition, the inaccuracies inherent in dietary measures used may be to blame. For this reason, it may be more informative to study specific behaviors such as fruit and vegetable intake, unhealthy eating indices, meal patterning, and alcohol intake. Moreover, the underlying factors influencing these changes are of particular interest.

2.4 SOCIAL SUPPORT

Social support for dietary and exercise behavior change can be instrumental in helping individuals adopt and sustain new eating and exercise patterns.⁸⁸ Social support has been defined as “the social resources that persons perceive to be available or that are actually provided to them by nonprofessionals in the context of both formal support groups and informal helping relationships.”³⁹ The term social support encompasses four distinct constructs: emotional, instrumental, informational, and appraisal.⁸⁹⁻⁹¹ Of these, emotional and appraisal support demonstrate the strongest relationships with weight loss.⁴⁰ Emotional support deals with empathy, encouragement, trust and concern,⁹⁰ while appraisal support involves constructive feedback, affirmation and re-enforcement for behavior.⁴⁰⁻⁴² Thus, the most influential sources of support generally come from the most intimate relationships.

Individuals may receive support from many sources. One’s spouse, family, friends, church community and colleagues form their natural support network.⁴⁰ Social networks can be described in terms of size, density (interconnectedness of members), boundedness (degree to which groups are defined by traditional structures), proximity (geographically), homogeneity, and how accessible the members are.⁹¹ However, network structure is not synonymous with social support, and this social infrastructure is termed *social integration*, which is its own distinct construct.

Social support refers to the quality, and one’s perception of the quality, of these relationships.⁹¹ Within social networks are individual social ties. The influence and strength of each relationship is determined and described by: 1) *frequency of contact* (further broken into type of contact, i.e. face to face, phone, text, etc.) 2) *multiplexity*, or the different types of support garnered from one relationship 3) *duration* of the relationship and 4) *reciprocity*, or the degree to

which support is bidirectional. Clearly, all support is not equal, and perception of support plays a large role in the efficacy of a relationship for providing meaningful benefit.

2.4.1 Types of Social Support

Social support can be measured in a variety of ways, encompassing all types of support in a single measure, or focusing on specific types of support, or support for specific behaviors. Global social support can be difficult to interpret as it encompasses many distinct constructs.⁹² It can be classified as social embeddedness, perceived social support, or enacted (received) support. Social embeddedness measures the number and strength of one's social relationships. This can involve identification of important support network members, or identification of individuals who provide specific types of support. As a measure of social support, embeddedness is limited by the assumption that the number of social contacts an individual has is directly related to the quantity and quality of the support they receive.

2.4.1.1 Perceived Support

Perceived support measures do not quantify social contacts, but instead assess one's confidence that support is reliably available from others when needed.⁹² Interestingly, perceived support has demonstrated a reliable association with emotional wellbeing and lower rates of depression, more so than other types of support.⁹³ The relationship between perceived support and psychological benefits has been attributed to positive stressor appraisals, and buffering of stress and stressful life events.^{89,94} While they are distinct constructs, it may not be possible to completely separate perceived and received support, as perception of reliable support may result from previous experiences with receiving effective support from others.

Stress is not the only context in which social support functions. Relational Regulation Theory⁹⁵ has been proposed as an alternative to the Stress and Coping Theory⁸⁹ to explain the relationship between social support and psychological health. Rather than acting primarily to buffer stress, Relational Regulation Theory suggests that support influences affect in regular day-to-day interactions. Under this theory, the association of perceived support with low distress is attributed to generic relationship quality, rather than enacted support.⁹⁵ Thus, the perceived value of received social support depends in part on the relationship between the provider and the recipient.

Capitalization support is a relatively new concept, wherein social support providers give positive feedback in response to successes and positive life events.⁹⁶ Grounded in Relational Regulation Theory,⁹⁵ the concept of capitalization support may be distinct from perceived support as they function under different circumstances – positive vs. negative life events.

2.4.1.2 Enacted Support

Social support can also be measured as one's retrospective appraisal of support actually provided.^{92,97} Despite their inherent theoretical overlap, perceived and enacted support, and social embeddedness are only weakly related.⁹² Some evidence suggests that perceived social support is determined not only by one's actual social contacts, but also by the recipient's tendency to view others as supportive, and to experience improved affect as a result.⁹⁸ Therefore, it is important to distinguish various types of social support when examining their relationship to health behaviors and weight.

2.4.1.3 Social Comparison and Affiliation

Social support is inextricably linked with the concept of social comparison and affiliation. Festinger's Social Comparison Theory posits that individuals desire self-evaluation and validation, and use comparisons with others as a subjective measuring stick for self-appraisal.⁹⁹ Taylor and Lobel have suggested that social comparisons serve three primary functions: 1) desire for affiliation, 2) desire for information about others, and 3) using others as a comparison for self-assessment.¹⁰⁰ Individuals under many types of stress use these comparisons as a coping mechanism by gaining useful information from those better adapted, and benefiting the ego by comparison with those less adapted than themselves. Festinger concluded that people tend to naturally affiliate with similar others, and to try to persuade those who are dissimilar.⁹⁹

Further research has concluded that people tend to compare themselves with others who are slightly better situated or higher functioning, a concept known as *upward drive*.¹⁰¹ Building on this idea, Smith and Sachs determined that upward comparisons and affiliation are more likely when an individual is primarily motivated by self-improvement.¹⁰² However, not everyone seeks to compare or affiliate with those they perceive to be superior to, or in better circumstances than themselves. Ego can get in the way of effective support, and a body of work has demonstrated that people often employ defense mechanisms when they judge that they are outperformed by another.¹⁰¹ Such strategies include self-handicapping by choosing a clearly superior target for comparison, distancing oneself from superior targets, or giving less helpful information to others.

Upward affiliation, or associating with individuals perceived to be higher functioning on a selected domain, is often due to preference for the company of individuals with knowledge and experience related to a particular threat, task or circumstance.¹⁰¹ In the context of weight loss,

this would suggest a preference for associating with those who have successfully lost weight. This upward preference is most likely when the individual is motivated primarily by a desire for self-improvement, rather than to benefit their self-image.

Associating upward may have beneficial effects on behavior change, and has demonstrated a positive impact in settings outside of weight management. Blanton et al. reported that high school students who compared themselves to students with higher GPAs at the beginning of a semester had the greatest improvement in grades over the course of that semester.¹⁰³ This result was replicated in the context of smoking cessation, a behavior change that shares some qualities with lifestyle change for weight loss.¹⁰⁴ Therefore, participants who chose to affiliate with others in the group who have successfully adopted new lifestyle behaviors and lost weight may fare better than those who associate with group members that remain ambivalent or resistant to change.

People may prefer to affiliate with individuals other than those to whom they compare themselves.^{101,105,106} Taylor and Lobel proposed that upward affiliation is most likely when self-improvement is the primary motivating factor, and that downward affiliation and comparisons are likely when coping with stress and boosting the ego are primary motivators.¹⁰⁰ Moreover, a strong sense of threat with an external locus of control can increase one's desire for downward affiliation and comparison.¹⁰⁵ This is supported by a study of breast cancer patients in which participants preferred affiliating with well-adjusted patients, while preferring to compare themselves to poorly adjusted patients, often with a worse prognosis.¹⁰⁷

Downward comparison can serve a beneficial role in some instances. Such comparison has been shown to improve negative affect for populations under stress or perceived threat.¹⁰¹ In the context of health behavior change, downward comparison may serve to distance individuals

from a behavior they wish to discontinue by creating a negative “prototype” for comparison.¹⁰⁸ Gibbons and Eggleston found that smokers in the process of quitting who had disparaging generic images of smokers (junkie, typical smoker), were less likely to relapse than those with more favorable generic images.

Affiliation may be important for weight management, as the individuals with whom one affiliates become their social support network. Thus, the information, encouragement, infrastructure and assistance one receives for her diet and exercise behaviors depends in part on the type of company they select. Furthermore, perceived social norms tend to influence intentions. Supporting this assertion, Yun et al. studied patients in a smoking cessation clinic and found that those with more friends and family who smoked were more likely to relapse.¹⁰⁹ Social support likely mediated this relapse, as current smokers are less likely to provide appropriate or adequate support for individuals attempting to quit. Applied to diet and exercise behaviors, it is likely that overweight and sedentary students consuming high calorie diets may not be capable of appropriate or adequate support for friends attempting to adopt and adhere to health dietary and exercise behaviors. Therefore, it could be that associating with a peer group that does not practice healthy behaviors could contribute to weight gain during freshman year. In this case, simply having social support may not be helpful for weight maintenance or loss, support specifically for diet and exercise behaviors may be more important.

Similar results have been found with regard to diet and exercise behaviors. A recent survey study reported that perception of proximal peer norms – both perceptions of peer values and observed peer behaviors – were related to intent to exercise and maintain a healthy diet.¹⁰⁹ However, perceived behaviors of distal peers were not related to intentions, suggesting that the

normative values of one's immediate peer group are most important in determining their values and intentions regarding diet and exercise.

Affiliation may also influence dietary intake by providing a reference point by which an individual judges appropriate portions and food choices.¹¹⁰ Studies placing participants with a confederate instructed to eat a small or a large amount have found that participants tend to eat about as much or slightly less than the confederate, regardless of the amount the confederate eats. Herman suggests that individuals use the others at the table as examples to set the upper-limit of what is an acceptable portion size. Furthermore, various situations can influence dietary intake. People tend to eat more when presented with a larger serving size, or an all-you can eat buffet. Thus, affiliating with others that consume high calorie diets, serve larger portions, or chose buffet or high calorie restaurants may increase caloric intake on a regular basis. This may be especially true in the dining hall setting, as portions are entirely self-determined and new students are in the process of forming new friendships.

2.4.2 Changes in Social Support during Freshman Year

The Theory of Belongingness states that humans have a basic need for a minimum quantity and quality of intimate relationships that involve both emotional attachment and frequent contact.¹¹¹ Feelings of belongingness are important to emotional health, as they are associated with positive affect. Some research suggests that simply belonging to a social network is sufficient to reduce stress, regardless of the actual support provided.⁸⁹ Chronically feeling a lack of belonging tends to produce negative affect and emotions. Baumeister and Tice¹¹² suggest that the absence of a social network may be the most common source of anxiety. Furthermore, decreased feelings of social acceptance and belonging may also lead to general depression.¹¹¹

Students transitioning from high school to college often experience a decrease in the quantity and quality of relationships with friends and romantic partners,³⁸ resulting in decreased self-esteem¹¹³ and increased depression⁵⁸ and loneliness.^{114,115} A vast majority of students cite relationships as a major source of stress during their first year of college.⁶⁸ Beginning in 1998, freshmen at a private East Coast university were given the opportunity to participate in a health behavior survey designed to follow the health behaviors of this population. A total of 396 freshmen surveyed over 4 years completed questionnaires in the August prior to their freshman year, and returned for follow-up questionnaires and physical assessments during April at the end of their first year. Over the course of freshman year, students gained an average 7.8 ± 5.2 lbs. (3.54 ± 2.36 kg). Significantly more students reported high stress due to roommates and living situations, and 15.6% fewer students reported high levels of happiness.

A short-term longitudinal study asked students to list up to 15 people who were important to them.¹¹³ Forty percent of students nearing the end of their first semester of college did not include any new college friends in their network. Another study found that nearly half of freshmen reported a desire for greater levels of social companionship.¹¹⁶ Perhaps more concerning is that 10.7% of these students surveyed responded “no-one” when asked their primary source of social companionship.

Previous studies have shown that low social support during this transition is associated with several negative psychological outcomes during freshman year. Ten weeks into freshman year, Paul and Brier¹¹³ surveyed students on social support and related measures. Mean loneliness scores were significantly higher than normative levels, and students rated their college social experience thus far as less positive than their expectations for this experience prior to college. Ramsay et al.¹¹⁶ evaluated adjustment to college and emotional, practical, informational

and social companionship support in 280 college students nearing the end of their freshman year. Emotional, practical, and social companionship support were all significantly higher in well-adjusted students than in those who were poorly adjusted.

The benefits of social support during freshmen year are apparent. Cross-sectional data supports a relationship between social support in college freshmen and self esteem,¹¹⁷ academic persistence,¹¹⁴ and lower ratings of loneliness.¹¹⁴ In addition, social support predicted lower stress and depression scores in 228 freshmen recruited from introductory psychology courses.⁵⁸ Loneliness and depression are also inversely related to social self-efficacy, or one's confidence in their ability to initiate social contact and make new friends.¹¹⁸

Adjustment may be hindered in some individuals by preoccupation with old friendships, to a degree that inhibits the formation of new ones.^{113,115} As a result of the need for belongingness, people tend to resist dissolution of relationships.¹¹¹ This is frequently the case for young adults leaving their high school friends to attend college, as they attempt to sustain these relationships through the transition, and spend less energy fostering new social ties.^{113,115} Paul and Brier¹¹³ developed a scale to assess "friendsickness", or a distressed preoccupation with and concern for rekindling precollege friendships. Ten weeks into their first semester, over 50% of the students surveyed showed moderate or high levels of friendsickness. Friendsickness was in turn associated with loneliness among college social group, and discrepancy between students' perceived social acceptance and the importance they place on this acceptance. Moreover, students with higher preoccupation with precollege friends were less likely to develop new meaningful friendships, and more likely to experience decreases in self-esteem. This finding was replicated in a study that examined the frequency of text messages to specific types of social

contacts.¹¹⁵ Fewer text messages to pre-college friends during the first semester of college was associated with less loneliness at the end of the semester.

As social support is instrumental to psychological health and weight management, this sudden drop in support during freshman year of college may play a role in concurrent weight gain. The role of social support during freshman year in predicting weight changes has received little attention. No studies to date have examined the relationship between social support specific to diet and exercise, and weight change during freshman year of college. Therefore, this study aims to determine whether social support during freshman year is related to concurrent weight change, and whether this relationship is stronger when support is specific to diet and exercise behaviors.

2.4.3 Social Media

Facebook is currently the most frequently accessed website overall, and is used by as many as 99.5% of students on some college campuses.¹¹⁹ Online database information estimates 96% of college students across the country are on Facebook,¹²⁰ and a majority of students report spending at least 30 minutes per day on the website.¹²¹ Thus it is likely that this social media website influences social support during college.

An online survey of 286 college undergraduates assessed various forms of social capital (the resources accumulated through relationships among people)-and Facebook usage and intensity of usage.¹²² While the intensity of Facebook use (quantified through online activity) did not influence bridging social capital (the integration of students into their current college community) in those with high self-esteem or high life satisfaction, greater intensity of Facebook use was associated with higher bridging capital in those with low self-esteem or low life

satisfaction. The authors suggested that Facebook use can lower the barriers to engagement in social activities and interactions for students who may otherwise avoid initiating communication with others. Other studies have suggested that the use of Facebook during the first year of college is primarily to interact with pre-existing friends from high school.^{123,124}

2.4.4 Social Support and Physical Activity in College Students

For social support to influence weight changes in college freshmen, it must impact one or both sides of energy balance (physical activity and diet). College men and women participating in focus groups cited social support as an important determinant of their engagement in physical activity.^{35,125} Specifically, students found that support from friends for physical activity made it easier to engage in exercise, and sustain their motivation.³⁵ Accountability emerged as an important determinant. Strong et al.¹²⁵ conducted focus groups in freshman and sophomore college students living on campus, and found that students frequently report that social support helps them to stay active, especially when they exercise with friends.

2.4.4.1 Cross-sectional Evidence

Previous research has demonstrated a correlation between social support and physical activity. Allgower and colleagues¹²⁶ assessed college students ages 18-30 on social support using the Social Support Questionnaire and exercise behavior, among other constructs. Variables were dichotomized and odds ratios calculated. High social support was defined as those having more than two persons who would be able to provide support in each of six challenging situations. Sedentary behavior was defined as exercising fewer than 5 times over the previous two weeks.

Low social support was associated with increased likelihood of sedentary behavior in both men (OR=1.54, $p=.001$) and women (OR=1.55, $p=.016$).

A random digit dial telephone survey in the Ontario region of Canada found similar associations.¹²⁷ The authors surveyed 1557 adults regarding social support and exercise constructs related to the theory of planned behavior and stages of change. Social support was significantly associated with stage of behavior change for exercise ($r=0.23$, $p<.001$), intention to exercise ($r=0.23$, $p<.001$), perceived behavioral control of exercise ($r=0.17$, $p<.001$), attitude toward exercise ($r=0.23$, $p<.001$), and perceived subjective normative value of exercise ($r=0.30$, $p<.001$). This study was limited by a single item used to capture social support for exercise, as well as the lack of quantification of current physical activity.

A more robust study recruited 363 college students from introductory psychology courses and administered the Social Support and Negativity from Friends survey, and Leisure Time Exercise Questionnaire.¹²⁸ The social support survey used is designed to assess companionship, esteem, and informational social support specifically from friends, along with several unsupportive behaviors from friends. All types of social support were significantly correlated with total leisure time physical activity (companionship support- $r=0.22$ $p<.001$; esteem support- $r=0.49$ $p<.001$; informational support- $r=0.20$ $p<.001$). Together, these studies support an association between social support for exercise and higher levels of physical activity that warrants further study.

2.4.4.2 Longitudinal Evidence

Similarly, Wallace et al.⁷⁵ found that social support for physical activity from friends significantly predicted students' current exercise behaviors, along with exercise specific self-efficacy and history of physical activity. This study used logistic regression to assess various

social cognitive characteristics as predictors of stage of exercise behavior change (based on the transtheoretical model of behavior change). Scores on the Sallis Social Support for Exercise scale significantly loaded onto the first factor, with a standardized function coefficient of 0.37. This finding suggests that behavior specific support may be important for determining physical activity patterns, and could ultimately be predictive of changes in weight.

There is also evidence that physical fitness level may spread within social networks.¹²⁹ The United States Air Force Academy randomly assigns students to peer groups with whom they live, eat, and spend their recreational time. Carrell et al.¹²⁹ used United States Air Force fitness scores assessed in high school, and again during the year of graduation to determine the effect of one's peer group's fitness level on that student's own change in fitness over the course of college. The fitness of one's peer group had an effect on that student's own change in fitness that was 40-70% the magnitude of the effect of that student's own baseline fitness level (depending on what variables were controlled). Subsequent analyses revealed that the least fit members of a student's peer group were responsible for 85% of that student's fitness in college. Thus, it appears that associating with less fit and less active individuals has a greater potential to influence one's own exercise and activity habits than associating with individuals with higher levels of physical activity and fitness. Those with the lowest baseline fitness were the most susceptible to negative peer influence.

While this evidence suggests that support specific to physical activity and exercise is of primary importance for influencing physical activity behaviors in college, it is also possible that simply having a stronger social network and successfully acclimating to college can improve physical activity behaviors. Based on a latent social profile analysis, Mailey et al.¹³⁰ found that college freshmen with decreased self-esteem and quality of life had greater declines in physical

activity and gained more weight than those with stable or improved self-esteem and quality of life. Perceived social support may contribute to acclimation to college and thereby influence physical activity and body weight.

2.4.5 Social Support and Dietary Behaviors in College Students

College students are surrounded by opportunities to consume high fat and high calorie foods, in vending machines, buffet-style dining halls, and à la carte dining facilities.³⁵ Unfortunately, students tend to place higher priority on cost and convenience than they do on health, often making unhealthy options seem appealing. This may make the eating environment in college particularly difficult to navigate in a way that prevents weight gain. Social support may play a role in determining the dietary choices students make as they acclimate to college.

2.4.5.1 Cross-sectional Evidence

Several cross-sectional studies have examined the relationship between social support and healthy eating behaviors. A recent study used the Health Beliefs Survey, 7-day activity logs verified by pedometer, and 4-day food records to assess the relationships between social support for diet and exercise and the associated behaviors.¹²⁵ Social support for dietary behaviors was significantly associated with fiber intake ($r=.43$, $p=.006$) and servings of whole grain ($r=.35$, $p=.003$). Similarly, Brug et al.¹³¹ found that social influence was significantly associated with both intention to eat salads ($r=.19$, $p<.01$) and frequency of eating salads ($r=.28$, $p<.01$).

Several cross-sectional studies have used fruit and vegetable intake as a measure of healthy eating behaviors, and contrary to Brug et al., have found significant associations with social support. A nationally representative random digit dial survey in 1997 found that

interpersonal factors and related awareness explained 24% of the variance in fruit and vegetable intake.¹³² Likewise, baseline data from a nutritional intervention in African Americans found that psychosocial variables accounted for 29% of baseline fruit and vegetable intake.¹³³ Specifically, social support was a significant predictor of fruit and vegetable intake with a regression coefficient of 0.17 ($p < .01$). Higher social support specific to fruit and vegetable intake was also associated with greater servings/day ($p < .01$).

2.4.5.2 Qualitative Evidence

College students have themselves frequently reported the influences their friends have on their eating behaviors. Smith-Jackson and Reel⁶² conducted semi-structured interviews with freshmen women regarding weight changes and related influences. Women tended to view weight gain as inevitable and reported that their dietary choices were influenced by friends, as well as comparisons with their peers. Focus groups have also pointed to social support as a determinant of dietary choices. Lacaille et al.³⁵ reported that students found that it was easier to maintain healthy eating behaviors when the friends with whom they ate also employed those behaviors. Similarly, students found their roommates' eating behaviors to influence their own, and that roommates who shared healthy foods were especially helpful. Focus groups conducted in first and second year students at a large East Coast university found that students feel their eating behaviors are strongly influenced by their college friends as the majority eat two or more meals with these friends each day. Conversely, many students stated that their family had minimal influence on their eating behavior. For this reason, it may be most important to focus on social support from friends when examining the influence of support on behavior in college freshmen.

2.5 CONCLUSION

It is apparent that weight gain during the freshman year of college is a common problem with significant repercussions. Though average weight gains are lower than the suggested “freshman fifteen”, a certain subset of individuals appear to be susceptible to rapid and significant weight gain. These gains are likely attributable to decreases in physical activity, changes in dietary behaviors, or both, that have been consistently reported in the literature. What is not known, is what makes some individuals more susceptible than others to these changes. While social support is linked to engagement in healthy dietary and exercise behaviors, the importance of specific types of social support for physical activity, diet and ultimately weight have not been examined as predictors of weight gain in college.³⁵ This study aims to expand on the knowledge base by examining the relationship between social support and weight change during freshman year, as well as defining the roles of support specific to diet and exercise for engagement in those behaviors and ultimately changes in weight. This study is intended to answer the question of whether social support during freshman year is related to weight changes, as well as whether social support must be specific to weight-related behaviors for effect, or whether simply developing a sound support network is sufficient to improve weight and behavioral outcomes.

3.0 METHODOLOGY

3.1 SUBJECTS

A total of 100 college freshmen (50 male, 50 female, age 18-20 years) residing in on-campus dormitories at the University of Pittsburgh were recruited to participate in this study. Exclusionary criteria were as follows:

1. Presence of any condition that may limit one's ability to exercise.
 - a. Because the influence of social support on exercise and physical activity is a primary outcome in this study, a physical disability preventing one from engaging in exercise could act as a confounding factor.
2. Presence of a medical condition that may alter one's metabolism, such as thyroid disease.
 - a. Conditions disrupting energy balance would mask changes in diet and exercise behaviors, thus confounding the relationship between these behaviors and changes in body weight.
3. Currently taking any medication that could influence one's metabolism (i.e., synthroid).

- a. As with medical conditions influencing metabolism, such medications could confound the relationship between diet and exercise behaviors and changes in body weight.
- 4. Women who are pregnant, or have been pregnant during the previous 12 months.
 - a. Pregnancy, delivery, and nursing all influence body weight dramatically, thus confounding the associations of interest.
- 5. Currently taking any psychotropic medications.
 - a. Many psychotropic medications are known to influence body weight. Therefore, these medications could influence changes in body weight during freshman year, independent of diet, physical activity, and social support.
- 6. Participation in varsity athletics at the University.
 - a. Varsity athletes have obligatory physical activity as part of their training. Therefore, it is unlikely that social support could have a significant influence on diet and exercise behaviors in this population.
- 7. Absence of disordered eating.
- 8. BMI < 18.5
 - a. Due to the safety concern associated with underweight BMI, students who's BMI is below 18.5 will be referred to health services.

3.2 RECRUITMENT AND SCREENING PROCEDURES

Participants were recruited through flyers posted in campus dining halls and freshman dorms. Flyers advertising the study were sent to mailboxes of first year students living on campus. This method was selected to avoid biasing the sample by recruiting from specific courses. Potential subjects were instructed to call the Physical Activity and Weight Management Research Center for more information. During this call, individuals were read a description of the study, including potential risks and benefits. If the individual was interested, a brief telephone screen was conducted to determine the individual's eligibility. Individuals who were eligible to participate provided contact information and scheduled a single assessment visit.

3.3 STUDY DESIGN

All measures were assessed in a single session. This study used a cross sectional research design. Participants were instructed to report to the Human Performance lab at Trees Hall at the University of Pittsburgh wearing light clothing.

Upon arrival, the study was explained in detail and subjects were encouraged to ask any pertinent questions. Once all questions were answered to the subject's satisfaction, he or she provided written consent in accordance with IRB approved procedures. The purpose of the study was temporarily undisclosed to prevent bias in participant responses. First, questionnaires were administered to assess social support, dietary behaviors, current physical activity, smoking status, depression, self-esteem, and loneliness. Subjects then underwent private assessments of

height, weight, and body composition. Once all assessments are completed, subjects were given a written debriefing, and were paid \$20 for participation.

All testing sessions occurred during spring semester 2013 between January 19th and February 22nd in the Human Performance lab at Trees Hall, at the University of Pittsburgh.

3.4 ASSESSMENT COMPONENTS

3.4.1 Social Support

Social support was measured using four scales in order to encompass various domains. Global social support was assessed using the Social Provisions Scale (perceived support), and the Inventory of Socially Supportive Behaviors (enacted support). These two measures were scored separately as Global-Perceived (SPS), and Global-Received (ISSB). Social support for diet and exercise was assessed using the Sallis Social Support and Exercise Survey, and Social Support and Eating Habits Survey. These surveys were modified to focus on individuals transitioning to college rather than those attempting to lose weight or change their health behaviors. Participants were instructed to answer these scales relative to the first two months of college. In addition, participants were asked whether the social support they receive from friends had increased, decreased or stayed about the same since entering college.

3.4.1.1 Global Support-Social Provisions Scale

General perceived social support was assessed using the Social Provisions Scale (Global Perceived) [Appendix A]. This scale was chosen as it is a good measure of perceived support,³⁹

which has linked to better health outcomes more consistently than received support.^{92,134} The questionnaire has low participant burden as it is self-administered and takes approximately 5 minutes to complete. The SPS asked subjects to rate their agreement/disagreement with statements about the supportiveness of their current relationships. These statements are designed to encompass six theoretical types of support. These are practical help, informational support, emotional support, social integration (belonging to a group of similar peers), reassurance of worth, and opportunity to provide reciprocal support. An example statement is “There are people I can depend on to help me if I really need it”. The SPS has demonstrated high reliability (Chronbach’s alpha = 0.93). The scale’s validity has been demonstrated by correlation with other validated measures of support, such as satisfaction with support, number of supportive persons, number of helping behaviors, and attitudes towards support. Global-Perceived was calculated by first reverse coding negative items, and summing the resulting scores.

3.4.1.2 Global Support-Inventory of Socially Supportive Behaviors

In addition, subjects completed the Inventory of Socially Supportive Behaviors (Global-Received) [Appendix B].¹³⁵ This measure was included for two reasons. First, in contrast to the SPS, the ISSB quantifies received support,³⁹ and has demonstrated low correlation with measures of perceived support.¹³⁴ Inclusion of both scales allows for a more complete picture of subjects’ support. Second, the ISSB has been used widely to measure social support, and will provide an avenue for comparison. Subjects were asked to rate the frequency with which they have received 40 supportive behaviors during the past month. Responses are on a five-point ordinal scale as follows, (1=not at all, 2=once or twice, 3=about once a week, 4=several times a week, 5=about every day). Global-Received was calculated by first reverse coding negative items, and summing the resulting scores.

The ISSB has demonstrated reliability in undergraduate students, with an average test-retest reliability of $r=0.88$.¹³⁵ The internal consistency is also high with a Chronbach's alpha of 0.93 and 0.94 on repeated tests. It has been validated by a moderate correlation ($r=.32-.42$) with support network size as assessed by the Arizona Social Support Inventory.¹³⁵

3.4.1.3 Behavior Specific Support-Social Support and Eating Habits Survey

Diet specific social support was assessed by the Social Support and Eating Habits Survey [Appendix C] developed by Sallis et al.¹³⁶ This scale was adapted to accommodate individuals who are not necessarily attempting to change their diet or to lose weight, with slight wording modifications to make the scale more relevant for college students living in dorms. Subjects rated the frequency their friends or peers had done each of ten statements related to support or lack of support for healthy eating. Ratings occur on a five-point scale ranging from 'not at all' to 'very often'. This scale contains subscales for support for family and friends, each of which can be further divided into items assessing "encouragement" and "discouragement" for healthy eating behaviors. Encouragement and discouragement items were summed separately, and then the discouragement score was subtracted from the encouragement score. Test-retest reliability is high ($r = 0.78-0.81$) and internal consistencies of positive and negative comments had Chronbach's alphas of 0.87 and 0.80 respectively.¹³⁶

3.4.1.4 Behavior Specific Support-Social Support and Exercise Survey

Exercise specific social support was assessed using the Social Support and Exercise Survey [Appendix D] developed by Sallis et al.¹³⁶ This scale was modified to accommodate individuals who are not necessarily attempting to become more active or to lose weight. Subjects rated the frequency their friends or peers had done each of 13 statements related to support or lack of

support for healthy eating using the same responses as the Social Support for Eating Survey. Test-retest reliability is high ($r = 0.79$) and internal consistency is high with a Chronbach's alphas of 0.87.¹³⁶ Scores for this scale are separate for family support and friend support, thus correlations for each are displayed. All items were summed with the exception of items 17 and 18. These items are omitted from scoring as recommended by Sallis et al.

3.4.2 Physical Activity

Current level of physical activity was assessed using the Paffenbarger Physical Activity Questionnaire.¹³⁷ This questionnaire is a validated measure of weekly physical activity patterns. On this questionnaire, subjects quantified stairs climbed, minutes of brisk walking, as well as any other sport, recreational, or fitness activity in which they have engaged during the past seven days. Results were reported as minutes of brisk walking, minutes of moderate to vigorous intensity physical activity, and total physical activity combining these two numbers.¹³⁷ Participants also answered a single item asking whether they were more active, equally active, or less active in high school than they are currently.

3.4.3 Sedentary Behavior

Sedentary behavior was assessed using the Sedentary Behavior Questionnaire used in the EARLY trials for young adults (Appendix E). This questionnaire asked respondents to report time spent in sedentary behaviors including watching television, playing computer or video games, doing office work that is not job-related, reading, listening to music, using the phone or during sedentary forms of transportation. Hours per day were reported for each activity for

weekdays, and again for weekend days. This measure does not assess occupational sedentary time. Because social support is unlikely to influence sedentary time while at work, this was determined to be an appropriate measure for the current study. Total hours of sedentary time per week was calculated by summing hours of each sedentary behavior separately for weekdays and weekends, and multiplying these totals by 5 (weekdays) and 2 (weekends) before summing into an aggregate score of total hours per week.

3.4.4 Dietary Behaviors

Dietary intake patterns were assessed using a questionnaire developed for the multi-center EARLY Trials funding by the National Institutes of Health (Appendix F). These questions were specifically developed to examine eating behaviors in young adults between 18-35 years of age. On this questionnaire, respondents rated the frequency with which they have consumed a variety of foods including sugar-sweetened beverages, diet beverages, and fast food over the past 30 days. Categorical responses (once per month, 2-3 times per week, etc.) were scaled to a common denominator of times per 30 days. Follow up questions to sugar-sweetened beverage items asked what percentage of the time sodas and fruit drinks consumed were diet. These values were used to calculate estimated non-diet sodas and non-diet fruit drinks consumed per months. Daily meal patterning was assessed as number of times during the past seven days that the student has eaten breakfast, lunch and dinner, as well as a rating of typical frequency of standard meals and snacks. The questionnaire also captured behaviors consistent with weight management and alcohol intake.

3.4.5 Loneliness

Loneliness was assessed using the Revised UCLA Loneliness Scale.¹³⁸ This 23-item survey asked respondents to rate how often they feel each of 20 statements on a four-point ordinal scale from never to often. These statements include “my social relationships are superficial”, and “I can find companionship when I want it”. Three additional items regarding different aspects of life were scored on a three-point ordinal scale from “hardly ever” to “often”. This scale has been validated in college students, nurses, teachers, and the elderly, and has demonstrated high internal consistency (coefficient α ranging from .89 to .94), and test-retest reliability over 1 year ($r=.73$).¹³⁹ For these analyses, the twenty-item loneliness scale was used due to its higher reliability and internal consistency. Construct validity has been supported by significant associations with satisfaction with interpersonal relationships, as well as measures of health and well-being.

3.4.6 Additional Questions

In addition to the above questionnaires, participants were also asked questions related to demographics, smoking, and depression. A brief questionnaire was used to describe the sample that included questions about age, gender, and race/ethnicity. Students were asked to report the distance in miles between their permanent residence (family) and the University of Pittsburgh. Participants were then asked to report whether they are participating in a club sport. Students participating in club sports were not excluded, but this data was collected to allow these students to be examined separately in an exploratory analysis. Smoking status was assessed with the questions developed for the EARLY trials, with an additional question to assess changes in

smoking habits upon entering college. Depressive symptomatology was assessed using the Centers for Epidemiologic Studies Depression Scale (CES-D). This brief questionnaire asked respondents to rate the frequency with which they have experienced each of 20 feelings or behaviors during the past week. This scale has demonstrated high factorial and discriminant validity.¹⁴⁰ Finally, participants were asked 4 items regarding social media use, including the primary site used, and the influence of their social media interactions on their diet and exercise behaviors.

3.4.7 Height, Weight and Body Composition

Height was measured using a stadiometer to the nearest 0.1 cm. Body weight was assessed using a Tanita-TBF 300A digital scale to the nearest 0.1 lbs. These measures were used to calculate BMI as kg/m^2 . Participants were instructed to dress in lightweight clothing, and to remove shoes, items in their pockets, and any accessories that could influence the measure. The scale used also assessed body composition through bioelectric impedance analysis. Participants stood on the scale in bare feet to allow a low-grade electric signal to pass from one foot to the other. This method uses the resistance and reactance encountered by the electric signal when passing through the body tissue to enter into an equation estimating body fat percentage. BIA has demonstrated validity in measuring percent body fat in college students with a Pearson correlation of .79 with DXA total body scan.¹⁴¹ Participants were asked to report their most recent body weight and height prior to the beginning of their first semester. These values were then used to compute BMI prior to entering college. Participants also answered a single item asking whether they had gained weight, lost weight, or stayed the same since beginning college.

3.5 STATISTICAL ANALYSES

Statistical analyses were performed using SPSS version 20. Changes in BMI from before college to the time of the assessment were calculated by subtracting the BMI calculated from each subject's self-reported weight and height prior to college from his or her objectively measured BMI at the time of the assessment. Spearman correlation coefficients were calculated to determine relationships between social support and BMI, change in BMI, physical activity, and dietary behaviors. In addition, Spearman correlations were calculated to determine relationships between exercise and diet specific social support and primary outcome measures. In order to determine the relative importance of each component of social support in outcome measures, a stepwise logistic regression analysis was conducted and standardized β coefficients were calculated for support types. A-priori sensitivity analyses were also conducted by gender.

As a secondary analysis, subjects were divided into groups based on having lost, gained or maintained weight since beginning college. Weight change scores were classified as weight gain (weight change $> 3\%$ initial body weight), maintained weight (weight change $\pm 3\%$ initial body weight), or lost weight (weight change $< -3\%$ initial body weight). A one-way between subjects ANOVA was then conducted to examine differences in social support among weight change categories. This analysis was repeated with classification based on the self-reported weight change classification.

Finally, exploratory analyses were performed to determine if relationships differed between certain subgroups or were mediated by depression or loneliness. Correlation coefficients were computed between social support measures and loneliness and depression, and again between loneliness and depression and primary outcome measures. All support variables

were then tested for correlations with body composition. These correlations were then computed again with support measures and sedentary hours per week. Next, correlation coefficients were computed between all measures of social support and both BMI and change in BMI in the following groups: Individuals who did not participate in club sports during their first two semesters of college, non-smokers, and overweight and obese individuals.

3.6 POWER ANALYSIS

To determine the sample size needed to detect a moderate effect size ($r = 0.3$) for primary aims, with power set at $1 - \beta = 0.8$ and the type I error rate set at $p = 0.05$, a power analysis was run using STATA version 10.1. It was determined that 85 subjects would be needed to detect a correlation of 0.3 with 80% power. In order to achieve adequate power for gender analysis, 100 subjects were recruited with a total of 50 males and 50 females.

4.0 RESULTS

4.1 SUBJECTS

Telephone screening calls were conducted for a total of 125 individuals. Of these participants, 118 were deemed to be eligible based on the criteria reported previously. Eighteen of these individuals missed their scheduled appointments, resulting in 100 subjects with 50 males and 50 females. The primary reasons for exclusion were medications known to influence body weight (3 individuals), and BMI below 18.5 (4 individuals). Fifty male and fifty female college freshmen (age 18.4 ± 0.5 years, BMI $24.0 \pm .3$ kg/m²) consented to participate in the study. All consenting participants completed the study. Of the total 100 subjects, 69 were at a healthy BMI (18.5 to <25.0 kg/m²), 25 were overweight (BMI = 25.0 to <30.0 kg/m²), and 6 participants were obese (BMI > 30.0 kg/m²) at the time of the physical assessment. Of the 50 male subjects, 40 were normal weight, 8 were overweight, and 2 were obese. Of the 50 female subjects, 29 were normal weight, 17 were overweight, and 4 were obese. The breakdown of subjects by BMI category is displayed in Figure 2. Descriptive statistics (mean \pm standard deviation) for the total sample and for men and women separately are shown in Table 1.

A one-way Analysis of Variance (ANOVA) was used to determine differences between male and female participants. Males were significantly taller ($p < 0.001$), weighed more ($p < 0.001$), had greater BMI as measured during spring semester ($p = .043$), and greater BMI prior

to college, calculated from self-reported height and weight ($p=.023$). The ANOVA revealed no significant differences between genders on any measure of social support. Male subjects reported significantly more minutes of moderate to vigorous intensity exercise excluding walking compared to females (242.7 ± 197.5 vs. 142.2 ± 130.0 minutes/week) ($p=.003$). Minutes of brisk walking and total minutes of exercise per week were not significantly different between genders.

Table 1. Descriptive statistics by total sample and by gender (mean \pm standard deviation)

	Total Sample	Males (n=50)	Females (n=50)	p-value
Age (y)*	$18.4 \pm .517$	$18.5 \pm .5$	$18.3 \pm .4$.003**
Height-current (cm)*	170.3 ± 8.3	175.7 ± 7.0	164.9 ± 5.4	.000**
Weight-current (kg)*	69.7 ± 12.0	76.1 ± 10.9	63.4 ± 9.5	.000**
BMI-current (kg/m²)*	24.0 ± 3.3	24.6 ± 3.2	23.3 ± 3.3	.043*
Pre-College BMI (kg/m²)*		23.7 ± 3.1	22.3 ± 2.9	.023*
BMI change (kg/m²)	1.0 ± 1.1	0.9 ± 1.0	1.0 ± 1.2	.793
Global-Perceived	85.9 ± 7.4	85.2 ± 7.7	86.5 ± 7.1	.406
Global-Received	118.6 ± 29.1	118.2 ± 31.2	119.0 ± 27.0	.894
Social Support for Exercise	21.1 ± 8.8 (family)	20.9 ± 8.4	21.4 ± 9.2	.804
	29.6 ± 8.8 (friends)	30.8 ± 8.7	28.4 ± 8.7	.169
Social Support for Diet:	4.5 ± 7.9 (family)	4.2 ± 8.4	4.7 ± 7.5	.773
	-2.4 ± 5.6 (friends)	-2.7 ± 5.2	-2.1 ± 6.1	.574
Moderate PA (min/week)*	192.5 ± 173.8	242.7 ± 197.5	142.2 ± 130.0	.003**
Walking (min/week)	113.3 ± 141.7	97.3 ± 105.9	129.2 ± 169.8	.263
Total PA (min/week)	305.7 ± 218.7	340.1 ± 212.7	271.4 ± 221.3	.117

*One-way ANOVA comparing males vs. females

*Significant at $\alpha < 0.05$

**Significant at $\alpha < 0.01$

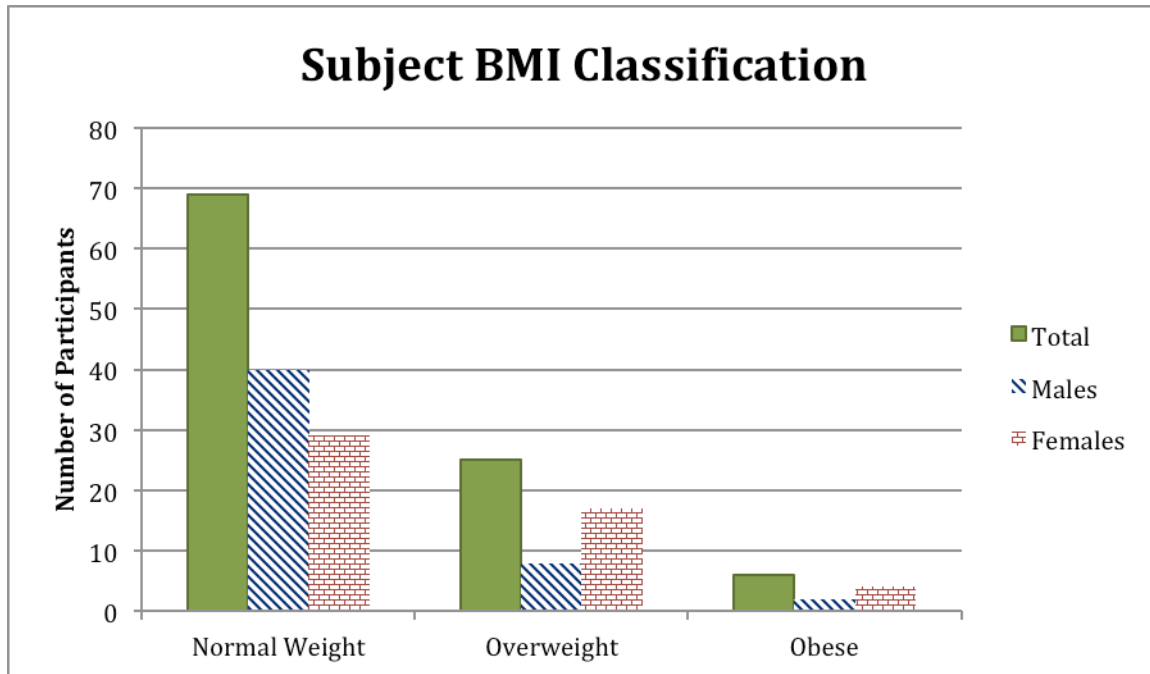


Figure 2. BMI Classification of subjects

4.2 ANALYSIS OF DATA BY SPECIFIC AIM

4.2.1 Specific Aim 1: Association Between Social Support and BMI

4.2.1.1 Specific Aim 1a: Global social support and BMI

Neither current BMI nor change in BMI followed a normal distribution ($W=.92$, $p<.001$ and $W=.97$, $p=.021$). These distributions were still not normal following a log transformation. Thus correlation analyses were conducted using Spearman's rho.

Current BMI was not associated with Global-Perceived ($\rho = -.09$, $p=.389$); but demonstrated a significant positive association with Global-Received ($\rho = .20$, $p=.045$). Non-parametric correlations found no significant association between change in BMI from before

college to the time of the assessment and either Global-Perceived ($\rho = .06$, $p=.529$) or Global-Received ($\rho = .05$, $p=.618$).

These correlations were then computed separately for men and women. When data were examined exclusively for males, both current BMI and change in BMI followed a normal distribution ($W=.96$, $p=.078$ and $W=.97$, $p=.245$). Thus, Pearson correlation coefficients were computed. In males, there were no significant associations between measures of global social support (perceived or received) and either current BMI or change in BMI. However, the relationship between Global-Received and current BMI approached significance in males ($r = .27$, $p = .060$). No relationships were significant in females. Data are displayed in Table 2.

Table 2. Correlations for global social support and BMI by gender

	Total Sample		Males		Females	
	<i>Current BMI</i>	ΔBMI	<i>Current BMI</i>	ΔBMI	<i>Current BMI</i>	ΔBMI
Global Perceived	$\rho = -.09$ $p=.389$	$\rho = .06$ $p=.529$	$r = .19$ $p=.186$	$r = .02$ $p=.911$	$r = -.05$ $p=.740$	$r = -.12$ $p=.410$
Global Received	$\rho = .20^*$ $p=.045$	$\rho = .05$ $p=.618$	$r = .27$ $p=.060$	$r = -.15$ $p=.309$	$r = .15$ $p=.316$	$r = .10$ $p=.487$

*Significant at $\alpha < 0.05$

**Significant at $\alpha < 0.01$

4.2.1.2 Specific Aim 1b: Social support for physical activity and BMI

Scores on the friend subscale of the Social Support and Exercise Survey followed a normal distribution ($W=.98$, $p=.196$), while scores on the family sub-scale were not normally distributed ($W=.93$, $p<.001$). Spearman's rho was used to calculate all correlations due to the non-normal distribution of outcome variables. No significant associations were found between either family or friend social support for physical activity and either current BMI or change in BMI (Table 3).

The relationship between social support for exercise and BMI was then examined separately in males and females. There was a significant relationship between family support for exercise and current BMI in males ($\rho = .30$, $p = .034$), but not in females. This relationship suggests that higher BMI is associated with greater family support for exercise in males. No significant relationships were found between social support for exercise and change in BMI in either gender, nor between social support from friends for exercise and current BMI in either gender. The data from these analyses is displayed in Table 3.

Table 3. Correlations between social support for exercise and BMI by gender

	Total Sample		Males		Females	
	<i>Current BMI</i>	ΔBMI	<i>Current BMI</i>	ΔBMI	<i>Current BMI</i>	ΔBMI
Family Support for Exercise	$\rho = .17$ $p = .099$	$\rho = .03$ $p = .806$	$\rho = .30^*$ $p = .034$	$\rho = .04$ $p = .789$	$\rho = -.01$ $p = .946$	$\rho = -.01$ $p = .924$
Friend Support for Exercise	$\rho = .15$ $p = .128$	$\rho = .11$ $p = .266$	$\rho = .08$ $p = .607$	$\rho = .08$ $p = .575$	$\rho = .14$ $p = .331$	$\rho = .01$ $p = .510$

*Significant at $\alpha < 0.05$

**Significant at $\alpha < 0.01$

4.2.1.3 Specific Aim 1c: Social support for healthy dietary behaviors and BMI

For the total sample, there was a significant association between social support for healthy eating behaviors from friends and current BMI ($\rho = .29$, $p = .004$). This relationship did not exist between family support for healthy eating and BMI ($\rho = .15$, $p = .135$). No significant relationships were found between measures of social support for healthy eating behaviors and change in BMI (family: $\rho = .01$, $p = .334$; friends: $\rho = .12$, $p = .228$).

These correlations were then computed separately for males and females. In males, there was a significant relationship between social support for healthy eating behaviors from friends

and current BMI ($\rho = .33$, $p = .018$), but not between support for healthy eating behaviors from family and BMI ($\rho = .21$, $p = .151$). Neither measure of support was significantly correlated with change in BMI (family: $\rho = -.03$, $p = .820$; friends: $\rho = .05$, $p = .709$).

In females, there were no significant relationships between social support for dietary behaviors (from friends or family) and BMI or change in BMI. However, the relationship between support for healthy eating behavior from friends and BMI approached significance ($p = .056$).

4.2.2 Specific Aim 2: Association Between Social Support and Physical Activity

4.2.2.1 Specific Aim 2a: Global Social Support and Physical Activity

Physical activity (as reported on the Paffenbarger Physical Activity Questionnaire) was quantified as minutes of brisk walking (Walking), minutes of moderate to vigorous intensity physical activity or exercise *excluding* walking (Non-Walking Exercise), and moderate to vigorous intensity physical activity *including* walking, or total exercise (Total Exercise). None of the exercise variables followed a normal distribution; therefore the non-parametric statistic Spearman's rho was used to test for correlations with social support variables.

Global-Received support was significantly associated with minutes of brisk walking per week ($\rho=.22$, $p=.031$). No other significant relationships were found between measures of global social support and exercise variables (data presented in Table 4).

Table 4. Correlations between global social support and exercise

	Total Sample		Males		Females	
	Global-Received	Global-Perceived	Global-Received	Global-Perceived	Global-Received	Global-Perceived
Brisk Walking	$\rho = .22^*$ $p=.031$	$\rho = .11$ $p=.269$	$\rho = .18$ $p=.216$	$\rho = -.01$ $p=.950$	$\rho = .29^*$ $p=.044$	$\rho = .21$ $p=.157$
Non-Walking Exercise	$\rho = -.06$ $p=.566$	$\rho = -.03$ $p=.781$	$\rho = -.10$ $p=.491$	$\rho = -.09$ $p=.555$	$\rho = .02$ $p=.905$	$\rho = .12$ $p=.438$
Total Exercise	$\rho = .08$ $p=.433$	$\rho = .11$ $p=.304$	$\rho = .03$ $p=.839$	$\rho = -.01$ $p=.937$	$\rho = .17$ $p=.242$	$\rho = .26$ $p=.079$

*Significant at $\alpha < 0.05$

**Significant at $\alpha < 0.01$

Correlations between global support variables and exercise were then analyzed separately for males and females. In males, Global-Received were normally distributed (Shapiro Wilk's $W=.98$, $p=.738$). However, Global-Perceived and exercise variables were not normally distributed, thus Spearman's rho was used to determine correlations among these variables. No significant relationships were found between global social support and exercise variables in males (Table 4).

In females, none of the exercise or global support variables followed a normal distribution. Therefore, Spearman's rho was used to test for correlations. Global-Received were significantly associated with minutes of brisk walking per week in female participants ($\rho=.29$, $p=.044$). No other significant correlations were found (data presented in Table 4).

4.2.2.2 Specific Aim 2b: Social Support for Exercise and Physical Activity

Next, the data were examined to identify relationships between social support for exercise as measured by the Sallis Social Support and Exercise Survey, and self-reported physical activity. Social support for exercise was significantly associated with both minutes of non-walking

moderate to vigorous exercise per week ($\rho = .36, p < .001$), and total exercise minutes per week ($\rho = .35, p < .001$), but not with minutes of brisk walking per week ($\rho = .07, p = .506$). Social support for exercise from family was significantly associated with minutes of non-walking moderate to vigorous exercise per week ($\rho = .22, p = .025$), but not with total minutes of exercise ($\rho = .12, p = .232$), or minutes of brisk walking per week ($\rho = -.02, p = .854$). Data are presented in Table 5.

Table 5. Correlations between social support for exercise and physical activity

	Total Sample		Males		Females	
Source of Support for Exercise	Friends	Family	Friends	Family	Friends	Family
Brisk Walking	$\rho = .07$ $p = .506$	$\rho = -.02$ $p = .854$	$\rho = .00$ $p = .993$	$\rho = -.02$ $p = .890$	$\rho = .15$, $p = .318$	$\rho = .01$ $p = .922$
Non-Walking Exercise	$\rho = .36^{**}$ $p < .001$	$\rho = .22^*$ $p = .025$	$\rho = .35^*$ $p = .013$	$\rho = .30^{**}$ $p = .003$	$\rho = .34^*$ $p = .016$	$\rho = .15$ $p = .289$
Total Exercise	$\rho = .35^{**}$ $p < .001$	$\rho = .12$ $p = .232$	$\rho = .38^{**}$ $p = .006$	$\rho = .23$ $p = .110$	$\rho = .30^*$ $p = .037$	$\rho = .00$ $p = .997$

*Significant at $\alpha < 0.05$

**Significant at $\alpha < 0.01$

In male participants, social support for exercise from friends was significantly associated with both minutes of non-walking moderate to vigorous exercise per week ($\rho = .35, p = .013$), and with total minutes of exercise per week ($\rho = .38, p = .006$), but not with minutes of brisk walking per week ($\rho = .00, p = .993$). Social support for exercise from family was significantly associated with minutes of non-walking moderate to vigorous exercise per week ($\rho = .30, p = .003$), but not with minutes of brisk walking per week ($\rho = -.02, p = .890$), or total minutes of exercise per week ($\rho = .28, p = .110$). Data are shown in Table 5.

In females, social support for exercise from friends was significantly associated with minutes of non-walking moderate to vigorous exercise per week ($\rho = .34, p = .016$), and total

minutes of exercise per week ($\rho = .30$, $p=.037$), but not with minutes of brisk walking per week ($\rho = .15$, $p=.318$). Social support for exercise from family was not significantly associated with any exercise variables in female subjects. Data are shown in Table 5.

4.2.3 Specific Aim 3: Association Between Social Support and Dietary Habits

4.2.3.1 Specific Aim 3a: Global Social Support and Dietary Habits

Dietary habits were assessed using a questionnaire developed for young adults in the EARLY weight loss intervention clinical trials. There is no validated method for computing a composite score for this questionnaire, so items were analyzed individually. First, Spearman correlation coefficients were computed for measures of global social support and dietary variables. All correlation coefficients and p-values are reported in Table 6. This table displays only correlations with cumulative sweetened beverage consumption, eating out, and snacking. Correlations with individual items within these categories can be found in the complete table in Appendix J.

Global-Received was significantly associated with monthly consumption of sodas ($\rho = .20$, $p=.046$), fruit drinks ($\rho = .25$, $p=.013$), and sports drinks ($\rho = .24$, $p=.014$). Spearman correlation coefficients did not reach significance when analyzing global social support and non-diet soda or fruit drink consumption. Total sweetened beverage consumption per month (calculated as the sum of consumption for each individual beverage) was also significantly associated with Global-Received ($\rho = .25$, $p=.004$). Global-Perceived were not significantly associated with sweetened beverage consumption.

In males, global social support was significantly associated with monthly fruit drink consumption for both Global-Received ($\rho = .50$, $p<.001$) and Global-Perceived ($\rho = .30$,

$p=.038$). The relationship between Global-Received and fruit drink consumption remained significant after adjusting consumption to exclude diet fruit drinks ($\rho = .35$, $p=.012$), but not between Global-Perceived and non-diet fruit drink consumption. Global-Received was also significantly associated with cumulative sweetened beverage consumption ($\rho = .39$, $p=.005$). Neither measure of global social support was significantly associated with consumption of soda, sports drinks, or energy drinks in males. In female subjects, Global-Received was significantly associated with sports drink consumption ($\rho = .37$, $p=.008$). No significant relationships were found between global support measures and soda, fruit drink, energy drink, or total sweetened beverage consumption in females.

Eating out was assessed with three items concerning fast food, restaurant meals, and buffet meals. Calculation of Spearman correlation coefficients between these items and global measures of social support yielded no significant relationships. Total frequency of eating out (aggregate of three separate items) was also not significantly associated with either measure of global social support. Neither global social support measure demonstrated a significant association with days in which subjects ate continuously without planning, or with the number of meals subjects prepared in their dorms each week. In male subjects, global social support was not significantly associated with measures of eating out, or frequency of continuous eating without planning in males. However, the relationship between Global-Received and fast food meals per month approached significance in males ($\rho = .28$, $p=.051$), as did the relationship between Global-Received and total frequency of eating out ($\rho = .24$, $p=.088$). In females, neither Global Received nor Perceived were associated with frequency of fast food, restaurants, buffets, or total frequency of eating out. Global support scores in females were also not significantly associated with frequency of eating continuously without planning, or meals prepared in dorm.

Subjects were asked to report the frequency with which they consumed breakfast, lunch, dinner, morning snack, afternoon snack, evening snack, and snack within an hour of bedtime each week. Only frequency of evening snacks was significantly related to global social support. Evening snacks per week was significantly associated with both Global-Received ($\rho = .23$, $p=.025$) and Global-Perceived ($\rho = .22$, $p=.028$). When all snacks were pooled, total frequency of snacking was significantly associated with Global-Received ($\rho = .22$, $p=.027$), but not Global-Perceived. Similarly, in male subjects, evening snack frequency and total snacking were associated with global social support. Evening snack frequency was significantly associated with both Global-Received ($\rho = .35$, $p=.014$) and Global-Perceived ($\rho = .29$, $p=.042$) in male subjects. Total snacking frequency was significantly related to Global-Received in males ($\rho = .32$, $p=.023$). In females, only afternoon snack frequency was associated with global social support in females. Afternoon snack frequency was significantly associated only with Global-Perceived ($\rho = .28$, $p=.049$). Total snacking frequency was not significantly associated with either Global-Received or Global-Perceived in females.

Finally, Global-Received was significantly associated with number of days on which participants drank alcoholic beverages in the past 30 days ($\rho = .23$, $p=.030$), but not with the number of alcoholic beverages consumed on these days. Global-Perceived was not significantly associated with alcohol consumption. In males, frequency of alcohol consumption was not significantly associated with global social support. However, there was a significant negative correlation between Global-Perceived and number of drinks consumed when drinking ($\rho = -.37$, $p = .014$). Global-Received in females was significantly associated with both frequency of alcohol consumption ($\rho = .33$, $p=.025$) and the number of drinks consumed on these days ($\rho = .31$, $p=.037$).

4.2.3.2 Specific Aim 3b: Social Support for Healthy Eating and Dietary Habits

Spearman correlation coefficients were then computed to analyze relationships between social support for healthy eating behaviors and dietary variables. All data for correlations between social support for healthy eating behaviors and dietary variables are displayed in Table 7. This table displays only correlations with cumulative sweetened beverage consumption, eating out, and snacking. Correlations with individual items within these categories can be found in the complete table in Appendix J. Neither social support for healthy eating behaviors from family nor support from friends were significantly associated with monthly consumption of sodas, fruit drinks, sports drinks, energy drinks, or total sweetened beverages.

These relationships were then examined separately for males and females. In males, no significant relationships were found between friend or family support for healthy eating behaviors and sweetened beverage consumption. This was true whether diet drinks were included or excluded. However, there was a negative relationship that approached significance between family support for healthy eating and soda consumption ($\rho = -.28$, $p=.054$). In female subjects, social support for healthy eating behaviors (from friends or family) was not significantly associated with consumption of soda, fruit drinks, sports drinks or energy drinks individually. However, friend support for healthy eating behaviors was significantly associated with lower cumulative consumption or non-diet sweetened beverages ($\rho = -.30$, $p=.032$).

For the total sample, no significant relationships were observed between either measure of social support for healthy eating behaviors and total frequency of eating out, or with fast food, restaurant, or buffet frequency individually. There was a significant negative correlation between family support for healthy eating behaviors and the frequency of eating continuously without planning ($\rho = -.22$, $p=.030$). Neither measure of social support for healthy eating

behaviors was significantly associated with meals prepared in the home (dorm) in the total sample.

Similar to the relationships seen in the entire sample, support for healthy eating behaviors was not significantly associated with eating out in males. Also like the entire sample, family support for healthy eating in males was significantly associated with fewer days of eating continuously without planning ($\rho = -.34$, $p=.017$) but not with frequency of preparing meals at home. In females, there were no significant relationships found between support for healthy eating and eating out. Likewise, neither measure of support for healthy eating was significantly associated with frequency of eating continuously without planning. Nor were these measures associated with frequency of preparing meals at home in females.

Neither friend nor family support for healthy eating behaviors was significantly associated with frequency of eating breakfast, lunch, dinner, or snacks at mid-morning, mid-afternoon, evening, or bedtime. In male subjects, there was a significant association between family support for healthy eating behaviors and frequency of eating breakfast ($\rho = .39$, $p=.005$). There was also a negative relationship between friend support for healthy eating and frequency of eating within an hour of going to bed ($\rho = -.30$, $p=.036$) in male subjects. No other significant relationships were found with respect to meal frequency in males. In females, support for healthy eating behaviors was not significantly associated with frequency of eating breakfast, lunch, dinner, or snacks at mid-morning, mid-afternoon, evening, bedtime or with total snacking frequency.

There was no significant association between family or friend support for healthy eating and alcohol consumption for the total sample. In males, while the relationships between global support and frequency of alcohol consumption were not statistically significant, the relationship

between Global-Received and alcohol consumption frequency approached statistical significance ($\rho = .30$, $p=.052$). However, higher Global-Perceived was associated with fewer drinks on those days that participants did drink alcohol ($\rho = -.37$, $p=.014$). In females there was no significant association between family or friend support for healthy eating and alcohol consumption in females.

Table 6. Correlations between Global Social Support and Dietary Variables

	All Subjects (n=100)		Males (n=50)		Females (n=50)	
	Global-Received	Global-Perceived	Global-Received	Global-Perceived	Global-Received	Global-Perceived
Sweetened Beverages	$\rho=.28^{**}$ $p=.004$	$\rho=.05$ $p=.605$	$\rho=.39^{**}$ $p=.005$	$\rho=.16$ $p=.278$	$\rho=.20$ $p=.170$	$\rho= -.01$ $p=.968$
Eating Out	$\rho=.05$ $p=.591$	$\rho=.05$ $p=.619$	$\rho=.24$ $p=.088$	$\rho=.20$ $p=.171$	$\rho=.107$ $p=.458$	$\rho= -.10$ $p=.508$
Unplanned Continuous Eating	$\rho=.05$ $p=.596$	$\rho=.03$ $p=.779$	$\rho=.15$ $p=.300$	$\rho=.06$ $p=.679$	$\rho=-.02$ $p=.900$	$\rho=-.01$ $p=.969$
Meals prepared in Dorm/w	$\rho=.01$ $p=.951$	$\rho=-.12$ $p=.243$	$\rho=.04$ $p=.795$	$\rho=-.05$ $p=.727$	$\rho=-.03$ $p=.860$	$\rho=-.20$ $p=.175$
Breakfasts/w	$\rho=-.04$ $p=.717$	$\rho=.13$ $p=.221$	$\rho=.05$ $p=.730$	$\rho=.25$ $p=.082$	$\rho=-.17$ $p=.247$	$\rho=-.06$ $p=.698$
Lunches/w	$\rho=-.09$ $p=.389$	$\rho=.09$ $p=.390$	$\rho=-.01$ $p=.941$	$\rho=.06$ $p=.703$	$\rho=-.17$ $p=.247$	$\rho=-.11$ $p=.462$
Dinners/w	$\rho=-.01$ $p=.919$	$\rho=.11$ $p=.283$	$\rho=-.04$ $p=.811$	$\rho=.14$ $p=.351$	$\rho=-.00$ $p=.984$	$\rho=.02$ $p=.879$
Snacking	$\rho=.22^{*}$ $p=.027$	$\rho=.15$ $p=.150$	$\rho=.32^{*}$ $p=.023$	$\rho=.06$ $p=.678$	$\rho=.13$ $p=.372$	$\rho=.16$ $p=.279$
Alcohol Consumption	$\rho=.23^{*}$ $p=.030$	$\rho=.01$ $p=.906$	$\rho=.30$ $p=.052$	$\rho=.14$ $p=.387$	$\rho=.33^{*}$ $p=.025$	$\rho=.06$ $p=.688$
Drinks/day	$\rho=.01$ $p=.358$	$\rho=-.20$ $p=.065$	$\rho=.03$ $p=.862$	$\rho=-.37^{*}$ $p=.014$	$\rho=.31^{*}$ $p=.037$	$\rho=.13$ $p=.410$

*Significant at $\alpha < 0.05$

**Significant at $\alpha < 0.01$

Table 7. Correlations between Social Support for Healthy Eating and Dietary Variables

Sallis Support Scales	All Subjects (n=100)		Males (n=50)		Females (n=50)	
	Friends	Family	Friends	Family	Friends	Family
Sweetened Beverages	$\rho = -.11$ $p = .261$	$\rho = -.01$ $p = .908$	$\rho = .03$ $p = .860$	$\rho = -.09$ $p = .524$	$\rho = -.30^*$ $p = .032$	$\rho = .10$ $p = .500$
Eating Out	$\rho = -.07$ $p = .482$	$\rho = -.10$ $p = .324$	$\rho = .13$ $p = .357$	$\rho = -.19$ $p = .180$	$\rho = -.20$ $p = .154$	$\rho = -.06$ $p = .696$
Unplanned Continuous Eating	$\rho = .02$ $p = .874$	$\rho = -.22^*$ $p = .030$	$\rho = -.11$ $p = .467$	$\rho = -.34^*$ $p = .017$	$\rho = .09$ $p = .544$	$\rho = -.11$ $p = .436$
Meals prepared in Dorm/wk	$\rho = .09$ $p = .380$	$\rho = .06$ $p = .580$	$\rho = .21$ $p = .142$	$\rho = .16$ $p = .276$	$\rho = -.01$ $p = .928$	$\rho = -.07$ $p = .622$
Breakfasts/wk	$\rho = .19$ $p = .064$	$\rho = .16$ $p = .123$	$\rho = .24$ $p = .100$	$\rho = .39^{**}$ $p = .005$	$\rho = .12$ $p = .420$	$\rho = -.10$ $p = .471$
Lunches/wk	$\rho = -.03$ $p = .755$	$\rho = .04$ $p = .667$	$\rho = -.05$ $p = .740$	$\rho = .15$ $p = .313$	$\rho = -.03$ $p = .859$	$\rho = -.06$ $p = .685$
Dinners/wk	$\rho = .08$ $p = .450$	$\rho = .12$ $p = .280$	$\rho = .22$ $p = .126$	$\rho = .14$ $p = .338$	$\rho = -.08$ $p = .569$	$\rho = .05$ $p = .740$
Snacking	$\rho = .02$ $p = .836$	$\rho = .02$ $p = .863$	$\rho = -.07$ $p = .631$	$\rho = .15$ $p = .293$	$\rho = .14$ $p = .346$	$\rho = -.07$ $p = .656$
Alcohol Consumption	$\rho = -.07$ $p = .497$	$\rho = -.02$ $p = .842$	$\rho = -.18$ $p = .253$	$\rho = -.08$ $p = .617$	$\rho = .18$ $p = .225$	$\rho = .13$ $p = .398$
Drinks/day	$\rho = -.10$ $p = .349$	$\rho = -.09$ $p = .382$	$\rho = -.05$ $p = .748$	$\rho = -.07$ $p = .653$	$\rho = .01$ $p = .928$	$\rho = .13$ $p = .938$

*Significant at $\alpha < 0.05$ **Significant at $\alpha < 0.01$

4.2.4 Regression of BMI on Measures of Social Support

To determine independent effects of social support measures on current BMI, a linear regression analysis was performed. Because BMI was not normally distributed, a natural log transformation was performed prior to analysis. The predictor variables included SPS, ISSB, social support for exercise from family and friends, and social support for healthy eating habits from family and friends. Only social support for healthy eating from friends emerged as a significant predictor ($p = .008$), but explained only 7% of the variance in BMI. In this model, a one standard deviation increase in friend support for healthy eating was associated with a higher BMI by 1.3 kg/m². Table 8 presents the unstandardized regression coefficients (B), the

standardized regression coefficients (β), the p values, and the R-square for two models – one model entering only friend support for healthy eating behaviors, and one entering both friend support for healthy eating behaviors and Global-Received.

While Global-Received was significantly associated with BMI in the correlational analysis, it did not emerge as an independent predictor of BMI when entered into a regression model with friend support for healthy eating behaviors ($\beta = .144$, $p = .15$).

Table 8. Linear Regression Analysis Explaining BMI

Model	Unstandardized Coefficient B	Standardized Coefficient β	p	R-Square
Model 1				
Friend Support for Diet	.006	.271	.006	.073
Model 2				
Friend Support for Diet	.005	.238	.019	.074
Global-Received	.001	.144	.150	

4.2.5 Specific Aim 4: Analysis of Variance by Weight Change Category

A one-way between subjects ANOVA was performed to detect mean differences in each social support score among those who lost weight (weight change $< -3\%$ initial bodyweight), maintained weight (weight change $\pm 3\%$ initial bodyweight), and those who gained weight (weight change $> 3\%$ initial bodyweight). According to this classification, 11 subjects lost weight (-3.9 ± 0.74 kg), 47 subjects stayed within 3% of their pre-college weight ($+0.2 \pm 1.0$ kg), and 42 subjects gained weight (4.0 ± 2.0 kg).

For subjects that lost weight, the assumption of normality was met for all social support variables. This assumption was met in those that maintained weight for all social support variables except Global-Perceived (Shapiro Wilk $W=.88$, $p<.001$), and Family Support for

Exercise (Shapiro Wilk $W=.92$, $p=.004$). In those that gained weight, the assumption of normality was met for Global-Received, Friend Support for Exercise, and Friend Support for Diet, but not for Global-Perceived (Shapiro Wilk $W=.85$, $p<.001$), Family Support for Exercise (Shapiro Wilk $W=.93$, $p=.020$), or Family Support for Diet (Shapiro Wilk $W=.93$, $p=.016$). The assumption of homogeneity of variances was met for all social support variables. No significant differences were found among weight change categories on Global-Perceived, Global-Received, Family Support for Exercise, Friend Support for Exercise, Family Support for Diet, or Friend Support for Diet. These data are presented in Table 9. The results were not different when the ANOVA was run separately by gender.

There was no significant differences in current BMI between those who lost weight (24.2 ± 4.1 kg/m²), maintained weight (23.5 ± 3.3 kg/m²), and those who gained weight (24.4 ± 3.0 kg/m²). To test for differences among current weight categories, subjects were reclassified as normal weight (BMI 18.5-24.9 kg/m²), overweight (BMI 25.0-29.9 kg/m²), or obese (BMI ≥ 30.0 kg/m²). The majority of subjects were normal weight ($n=67$), 25 subjects were overweight, and 6 subjects were obese. A significant difference was found among BMI categories for Family Support for Healthy Eating ($p = .021$). Multiple comparisons were performed to identify mean differences between BMI categories. Obese participants reported significantly higher Family Support for Healthy Eating (12.5 ± 8.7) than did normal weight participants (3.4 ± 7.5) ($p = .018$). Differences in Friend Support for Healthy Eating scores among BMI categories approached statistical significance ($p = .052$). Obese subjects reported higher social support from friends for healthy eating behaviors (2.3 ± 7.4) than did normal weight subjects (-3.1 ± 5.6). This difference also approached statistical significance ($p = .058$).

Table 9. Social Support by Weight Change Category

Social Support Measure	Lost Weight	Maintained	Gained Weight	P-value
Global-Perceived	84.3 ± 2.1	86.5 ± 0.9	85.6 ± 1.3	.638
Global-Received	118.5 ± 9.8	111.1 ± 4.9	117.8 ± 4.1	.868
Family Support for Exercise	21.9 ± 2.6	21.4 ± 1.4	20.7 ± 1.3	.942
Friend Support for Exercise	28.1 ± 3.5	30.0 ± 1.2	29.6 ± 1.4	.819
Family Support for Diet	6.3 ± 2.6	4.2 ± 1.0	4.7 ± 1.4	.696
Friend Support for Diet	-4.2 ± 1.1	-2.1 ± 1.0	-2.2 ± 0.8	.552

4.3 DEPRESSION AND LONELINESS

One proposed pathway by which social support could influence BMI and weight related behaviors is through its effect on depression and loneliness. Therefore, correlations were run between measures of social support and depression and loneliness.

4.3.1 Loneliness

Average loneliness score was 29.6 ± 8.9 out of a possible 80. Higher scores indicate greater perception of loneliness. Most students scored low on loneliness, resulting in a positively skewed distribution that did not meet the assumption of normality (Shapiro Wilk $W = .87$, $p < .001$). Therefore, Spearman's rho was calculated to determine associations between loneliness and measures of social support.

Loneliness demonstrated a significant negative relationship with every measure of social support, suggesting that greater loneliness is related to lower social support in all domains.

These data are presented in Table 10. Loneliness was not significantly correlated with current

BMI, change in BMI, walking min/wk, moderate exercise min/wk, or total exercise min/wk (data not shown). However, loneliness was not significantly associated with either current BMI, or change in BMI (Table 11). Therefore, loneliness cannot be a mediator of the relationship between social support and BMI.

Table 10. Relationships between Social Support and Loneliness and Depression

Measure of Social Support	Loneliness	Depression
Global-Perceived	$\rho = -.72^{**}$ $p < .001$	$\rho = -.35^{**}$ $p = .001$
Global-Received	$\rho = -.32^{**}$ $p < .001$	$\rho = -.02$ $p = .835$
Family Support for Exercise	$\rho = -.21^{*}$ $p = .041$	$\rho = -.27^{**}$ $p = .007$
Friend Support for Exercise	$\rho = -.31^{**}$ $p = .002$	$\rho = -.09$ $p = .360$
Family Support for Diet	$\rho = -.29^{**}$ $p = .004$	$\rho = -.27^{**}$ $p = .006$
Friend Support for Diet	$\rho = -.34^{**}$ $p = .001$	$\rho = -.04$ $p = .663$

*Significant at $\alpha < 0.05$

**Significant at $\alpha < 0.01$

4.3.2 Depression

Depression scores as measured by the CES-D ranged from 0-40 (maximum possible 60) with a mean score of 10.1 ± 7.5 points. Most students exhibited low depressive symptomatology. Depressive symptomatology demonstrated a significant negative correlation with Global-Perceived ($\rho = -.35$, $p = .001$), family support for exercise ($\rho = -.27$, $p = .007$), and family support for healthy eating behaviors ($\rho = -.27$, $p = .006$), suggesting a relationship between higher depressive symptomatology and lower levels of perceived social support, as well as lower levels of support for healthy diet and exercise habits from family members. Depressive symptomatology was not significantly associated with either current BMI, or change in BMI (Table 11). Therefore, depressive symptomatology cannot be a mediator of the relationship between social support and BMI.

Table 11. Relationships between BMI and potential mediators

	<i>Current BMI</i>	<i>ΔBMI</i>
Loneliness	$\rho = -.04$ $p = .724$	$\rho = -.01$ $p = .951$
Depressive Symptoms	$\rho = -.00$ $p = .988$	$\rho = .11$ $p = .263$

4.4 EXPLORATORY ANALYSES

4.4.1 Body Composition

Body composition ranged from 8.6 % to 44.2 % body fat. Mean body composition was $16.7 \pm 0.7\%$ for males and $27.4 \pm 0.8\%$ for females. Body fat percentages were normally distributed (Shapiro Wilk $W = .98$, $p = .079$), thus a Pearson correlation was calculated between body composition and current BMI. Correlations with non-normal variables were conducted using Spearman's rho. There was a significant positive relationship between body composition and current BMI ($r = .45$, $p < .001$), but not change in BMI. Higher body composition was associated with fewer minutes of non-walking moderate to vigorous intensity physical activity ($\rho = -.26$, $p = .007$), but had no significant relationship with either brisk walking or total exercise. Correlations were then computed for body composition vs. each measure of social support. Only the relationship between body composition and friend support for healthy eating was significant ($r = .28$, $p = .005$). This relationship was similar in males ($r = .35$, $p = .014$), but not in females ($r = -.09$, $p = .553$).

4.4.2 Sedentary Behaviors

Subjects averaged 69.3 ± 29.3 hours per week of sedentary activity. Females had slightly greater sedentary hours per week than males (72.5 ± 27.7 vs. 66.0 ± 30.8 hours/week), but this difference was not statistically significant ($p = .271$). Total sedentary behavior was not normally distributed (Shapiro Wilk $W=.88$, $p<.001$), thus Spearman's correlations were computed. In the entire sample, sedentary behavior was not associated with measures of global social support. However, sedentary hours/week was negatively associated with friend support for exercise ($\rho = -.25$, $p = .013$). The relationship between higher friend support for exercise and fewer hours of sedentary behavior per week was stronger when analyzed in males separately ($\rho = -.45$, $p = .001$). No other significant relationships were found between social support measures and sedentary behavior in either males or females.

4.4.3 Participation in Club Sports

Participation in club sports was assessed to determine whether competing as a club athlete may influence the relationship between social support and weight outcomes. Therefore, the analyses were run excluding subjects who had participated in club sports during either semester of college. Twenty-six participants had been on a club team during fall semester, spring semester, or both, and were excluded from this analysis. Spearman's correlations between measures of social support and both current and change in BMI for the 74 remaining participants were similar to the same correlations in the total sample. Similar to the results total sample, there was a relationship between friend support for healthy eating and current BMI ($\rho = .24$, $p = .039$), and a modest but non-significant correlation between Global-Received and BMI ($\rho = .22$, $p = .061$).

4.4.4 Smoking

Thirteen participants were either current smokers or had recently quit. Analyses were run excluding smokers and recent smokers to determine if the relationships between social support and weight outcomes changed when examining only non-smokers. In non-smokers, neither measure of global support was significantly associated with either current BMI or change in BMI. Current BMI was significantly associated with friend support for exercise ($p = .21$, $p = .048$) and friend support for healthy eating behaviors ($p = .26$, $p = .015$). Similar to the analysis in the total sample, change in BMI was not significantly associated with and measure of social support.

4.4.5 Social Media

Ninety-nine of the 100 subjects reported using social media. Participants were able to list multiple social media sites, thus frequencies do not sum to 100. Facebook was the most popular site used, and 62 subjects listed Facebook as the primary social media site used. Twitter was the second most frequently cited social media website, listed as the primary social media site for 31 participants. An additional 6 participants listed both Facebook and Twitter. Other social media sites used were Instagram, Pinterest, VK.com, and Snapchat, which were listed by one subject each.

Subjects reported largely that they did not feel social media influenced their dietary choices or eating behaviors. When asked to rate their level of agreement with the statement “My interactions on social media influence my dietary choices and/or eating behaviors”, 78% either disagreed or strongly disagreed. Another 14% were neutral, 6% agreed and only one subject

(1%) selected “strongly agree”. The same pattern emerged when subjects rated agreement with the statement “My interactions on social media influence my exercise habits and/or physical activity”. Sixty-seven percent of the sample selected either “strongly disagree” or “disagree”, another 21% selected “neutral”, 8% selected agree, and 3% selected strongly agree.

4.4.6 Analysis of Overweight and Obese Subjects

As relationships between social support and weight outcomes that exist in overweight and obese individuals could be obscured by their underrepresentation in this sample, relationships between social support measures and BMI were analyzed again, looking only at subjects who were overweight or obese as measured at the assessment during spring semester of freshman year. There were a total of 31 subjects with a BMI of 25 or greater. In this sub-sample, change in BMI was normally distributed (Shapiro Wilk $W = .97$, $p = .579$). Current BMI was not normally distributed ($W = .79$, $p < .001$), and was positively skewed. All social support variables met the assumption of normality in this sub-sample. Thus Pearson correlation coefficients were computed for associations with BMI change, and Spearman’s coefficients were computed for associations with current BMI.

There was a significant negative relationship between Global-Received and change in BMI ($r = -.40$, $p = .027$), indicating that higher global social support was associated with weight loss or reduced weight gain from before college to spring semester of freshman year. Global-Received was not significantly associated with current BMI. Global-Perceived was not significantly associated with current BMI or change in BMI. These data are presented in Table 12.

While there were no statistically significant correlations found between social support for exercise (family or friend) and either current BMI or change in BMI, there was a moderate negative correlation found between family support for exercise and current BMI that approached significance ($\rho = -.35$, $p = .053$). No other types of behavior-specific social support were significantly associated with BMI or change in BMI.

Table 12. Social Support and BMI in Overweight and Obese Subjects

	<i>Current BMI</i>	<i>ΔBMI</i>
Global-Perceived	$\rho = .02$ $p = .898$	$\rho = -.05$ $p = .792$
Global-Received	$\rho = .18$ $p = .343$	$\rho = -.40^*$ $p = .031$
Family Support for Exercise	$\rho = -.35$ $p = .053$	$\rho = -.21$ $p = .249$
Friend Support for Exercise	$\rho = .14$ $p = .469$	$\rho = -.07$ $p = .730$
Family Support for Diet	$\rho = .19$ $p = .302$	$\rho = -.18$ $p = .345$
Friend Support for Diet	$\rho = .04$ $p = .816$	$\rho = -.07$ $p = .725$

*Significant at $\alpha < 0.05$

4.5 SUMMARY

This study found no relationship between change in BMI from before college to the beginning of the second semester of freshman year and any measure of social support. However, when overweight and obese subjects were analyzed separately, there was a significant negative relationship between weight change and Global-Received, which represents received social support not specific to exercise or dietary behaviors. In addition, there was a highly significant

relationship between friend support for exercise and minutes of exercise per week. This relationship was consistent whether walking was included or excluded, and was significant in the total sample and males and females separately. There was no clear and consistent relationship between social support and healthy dietary behaviors. Higher global social support was associated with more frequent consumption of sweetened beverages and snacking, especially in males, as well as more frequent alcohol consumption. Social support specific to healthy eating behaviors from family demonstrated only a modest negative correlation with overeating in the total sample and support from friends for healthy eating behaviors was not significantly associated with any individual measures of dietary behaviors.

5.0 DISCUSSION

5.1 INTRODUCTION

The primary aim of this investigation was to examine the relationship between social support and BMI, change in BMI, and weight-related behaviors during freshman year of college. More specifically, this investigation sought to differentiate the relationship between general perceived and received social support and weight changes from the relationship between support specific to healthy eating and exercise behaviors. A secondary aim was to explore gender differences in these relationships.

Changes in BMI were not significantly associated with any social support variables in males, females, or the combined sample. Contrary to the study hypothesis, global social support and support for healthy eating behaviors from friends were modestly correlated with spring semester BMI such that higher levels of support were associated with higher BMI (Table 2). In a linear regression model, friend support for healthy eating behaviors emerged as the only significant independent predictor of BMI (Table 8). These relationships were dramatically different when isolating overweight and obese subjects. In this subsample, higher global social support was associated with less weight gain, and there was a trend toward significance correlating higher family support for exercise with lower BMI (Table 12). The following

sections will discuss the interpretation and practical significance of these findings, as well as the strengths and limitations of the study and future directions.

5.2 SOCIAL SUPPORT AND BMI

5.2.1 Global Support and BMI

Higher received global social support (ISSB) was associated with higher BMI, and this association was opposite the hypothesized direction (Table 2). This relationship remained significant when only males were considered, but not in females. Previous cross-sectional research examining general perceived social support in a different setting has also failed to find a negative relationship between general social support and BMI. The PACE study (Promoting Activity and Changes in Eating) assessed 2878 employees across 34 worksites in Seattle on global social support, BMI, and dietary and exercise behaviors.¹⁴² Regression analyses in the PACE study found no relationship between social support and BMI, or the majority of weight-related behaviors. Only small but statistically significant relationships were found between general social support and increased leisure time physical activity, and fruit consumption.

While the PACE study supports the absence of a negative relationship between global social support and BMI, it does not help to explain the positive association between support and BMI found in the present study. This difference may be unique to college students, as social support may be a proxy for social integration and more frequent obesogenic situations. Greaney and colleagues conducted focus groups in college students to identify barriers to healthy weight management.¹⁴³ Both males and females frequently cited social situations, ready access to

unhealthy food, and temptation as major barriers to maintaining a healthy weight. The results of the present study do not support the hypothesis that greater levels of global social support are related to improved BMI and BMI change during freshman year of college, and suggest that there may be a relationship between global support and higher BMI.

However, there are a host of other factors surrounding social interaction in college that may influence this relationship. Based on focus groups, another study found that along with social situations and access to unhealthy foods, lack of time, motivation, convenience, self-control, and the perception of few healthy options on campus were all frequently cited as determinants of weight related behaviors.³⁵ Thus, global social support appears to be responsible for only a small proportion of the variance the BMI of freshman students, as demonstrated by the small correlation found in the present investigation.

While not statistically significant, the relationship between global received support and BMI approached significance in males, and was stronger than for the entire sample (Table 2). Several factors may explain a positive relationship between general social support and BMI in college males. First, many first year college males are less concerned about weight,¹⁴⁴ and some even strive to gain weight.^{143,144} Conversely, the positive relationship may be the result of a desire for weight gain.⁷⁹

While social support has demonstrated positive effects on measures of depression, stress,⁵⁸ and life satisfaction,⁵⁷ these measures may be unrelated to changing weight related behaviors if the target individual does not perceive a need to change. In the current study, the majority of the participants were normal weight. A scatterplot of weight changes against social support in these individuals may be deceptive, as a higher BMI within this range is not necessarily a negative outcome. Therefore, it may be more meaningful to examine this

relationship in overweight and obese individuals alone, as weight changes and differences in this range are more clinically meaningful. Isolated analyses of overweight and obese subjects will be discussed further in section 5.6.

5.2.2 Social Support for Physical Activity and BMI

Social support for physical activity was not significantly associated with current BMI or change in BMI in the total sample, or in females. However, there was a significant positive association between family support for exercise and current BMI in males, such that higher family support for exercise was associated with higher BMI (Table 3).

This relationship must be considered in the context of a primarily healthy weight sample. It has been established that college males have a higher ideal BMI than college females.¹⁴⁵ In the current investigation, the most commonly cited exercise modality in males was weight lifting, which was reported by 54% of male subjects. As family support for exercise was significantly associated with both total exercise and non-walking exercise, it is possible that a positive relationship between social support for physical activity and higher BMI results from goals in college males that are focused on building muscle rather than losing weight. It is also possible that male students with a higher BMI are more likely to be encouraged to exercise by family members. Similar to the present study, Ball et al.¹⁴⁶ reported a positive relationship between social support for exercise and current BMI, using the same Sallis Social Support and Exercise Survey used in our study. Based on these findings, Ball et al. hypothesized the relationship between social support for exercise and BMI could be due a tendency for the friends and family of overweight individuals to support behaviors they perceive will benefit that individual's health.

Contrary to the present findings, at least one study has produced results that suggest a relationship between social support for exercise from friends and less successful weight loss.¹⁴⁷ Kiernan and colleagues found that women in a 6-month behavioral weight loss intervention who “never” experienced support from friends for exercise were the most likely to lose weight when compared with participants who reported various levels of support. Because this finding was in the context of a group-based intervention, Kiernan and colleagues suggested that the support received from the group had a larger effect in women with no strong natural support network. The difference in findings between this and the present study is likely due to the differences between the samples. All participants in the intervention study by Kiernan et al. were overweight and seeking weight loss, while only 31% of our sample was overweight and there was no way to determine whether they were trying to lose weight. Taken together these studies and the present findings suggest that while social support for exercise may be beneficial for those seeking to lose weight, the nature of this type of support is such that healthy weight individuals receive it less frequently.

5.2.3 Social Support for Healthy Eating Behaviors and BMI

It was hypothesized that social support for healthy eating behaviors from friends would be associated with lower BMI. However, this study found the opposite relationship. Higher friend support for healthy eating behaviors was independently associated with higher current BMI when entered into a regression model with other measures of social support, and was the only measure of support that demonstrated an independent association (Table 8).

While several studies have found a relationship between social support for healthy eating behaviors and engagement in healthy eating,^{125,133} this relationship between support for healthy

eating behaviors and higher BMI has been reported elsewhere. Using a similar measure of social support for dietary behaviors, Ball and colleagues¹⁴⁶ surveyed 790 females ages 18-23. These investigators reported that higher family support for healthy eating behaviors, and lower sabotage of healthy eating behaviors from friends, were significantly associated with higher BMI in women. Due to the cross-sectional nature of both the Ball et al. study and the current study, this relationship should be interpreted with caution, as the direction of the relationship is unclear. Ball et al.¹⁴⁶ suggested that the friends of overweight individuals may consciously avoid saying or doing things that they perceive could lead those friends to further weight gain.

Previous research has shown that supportive friends can indeed influence dietary behaviors. Strong et al.¹²⁵ conducted structured elicitation interviews regarding social support for dietary behaviors, assessed dietary intake with 4 day food logs, and assessed height, weight, body composition, and cardiorespiratory fitness in 43 college students. Social support for healthy dietary behaviors was associated with students' fiber intake ($r = 0.43$, $P = 0.006$), whole grain consumption ($r = 0.35$, $P = 0.03$) and several micronutrients including folate, calcium, iron, and potassium. Similarly, another focus group study found that students felt it was much easier to eat a healthy diet when they perceived that their peers were making healthy choices.³⁵ While this explanation is somewhat speculative, these findings suggest that the attempt of an overweight student's friend to support healthy dietary behaviors could indeed influence that student's behaviors and ultimately bodyweight.

Family support for healthy eating behaviors was not significantly related to BMI (Section 4.2.1.3). Students' parents may influence dietary intake prior to college, but studies have shown that this influence tends to decrease in later adolescence prior to college.¹⁴⁸ While friends may have a stronger influence on college students' attempts to make healthy dietary choices, students

have reported that their idea of what constitutes a healthy meal comes from their parents.¹²⁵ The influence of family on dietary intake has been established previously in a study that collected 3-day food records from 387 middle-class families.¹⁴⁹ Familial inheritance accounted for 40% of the variability in food intake, and same-generation correlations were stronger than parent-child correlations. Therefore, both family and friends may exert influence on the dietary behaviors of college students. However, the influence of family may be more residual and thus not captured by the questionnaire used in this study, which focused on the words, actions, and behaviors of family and friends in a recent time frame.

5.3 SOCIAL SUPPORT AND PHYSICAL ACTIVITY

Weight related behaviors could be more clinically important than current BMI in this primarily normal weight sample, as these behaviors tend to track into adulthood and can determine weight trajectory.^{15,17} This section will discuss the role of social support in the physical activity behaviors of college freshmen.

This study found no relationship between global social support and minutes of moderate to vigorous intensity exercise per week (Table 4). However, exercise-specific social support from friends exhibited a robust relationship with greater total exercise and moderate to vigorous exercise excluding walking, in both males and females (Table 5). This relationship is consistent with previous research examining social support for exercise and physical activity habits in college students. A sample of 363 college students was administered the Leisure-Time Exercise Questionnaire, as well as questions regarding perceived social norms regarding exercise, intent to exercise, and social support for physical activity from their friends.¹²⁸ Total leisure-time exercise

was most strongly correlated with esteem social support ($r = .49, p < .001$), followed by perceived behavioral control. Moreover, esteem support was the strongest predictor of strenuous exercise when entered into a regression model with other psychosocial constructs. Esteem support is focused on recognition of mastery, or compliments and positive comments regarding the recipient's skills or commitment. The measure of social support for exercise used in this study captures a slightly different construct as items are centered around exercising together (companionship), encouragement, and emotional support. Despite the differences in the type of support for exercise, the relationships observed in this and the current study were similar.

Leslie and colleagues¹⁵⁰ reached a similar conclusion by comparing sufficiently active and insufficiently active students on exercise-specific social support. College students were dichotomized into activity groups defined by an estimated weekly exercise-induced energy expenditure of 800 or more kcal/week (sufficiently active) or less than 800 kcal/week (insufficiently active). Low social support from family and from friends were both associated with higher odds of being insufficiently active in both males and females. In males, low family support for exercise and low friend support for exercise were associated with 48% and 45% higher odds of being insufficiently active respectively. In females, the effect of family support for exercise was more pronounced (55% higher odds of being insufficiently active), than friend support for exercise (22% higher odds). Contrary to our finding that friend support for exercise was the strongest predictor of exercise participation, low family support for exercise had the greatest odds ratio for insufficient activity level of all variables assessed. However, low support from friends carried the second greatest odds in both genders. It may be that social support for exercise exerts a similar influence regardless of the source, and measurement differences may account for the slight difference in results between studies.

While contrary to the findings of the present investigation, a stronger relationship between family support for exercise and physical activity in females is supported elsewhere in the literature. Using the same Sallis social support scale that was used in the present study, Wallace and colleagues surveyed 937 undergraduate students.⁷⁵ Friend support for exercise was the strongest predictor of exercise stage of change in males ($r = .36$) while family support for exercise was the strongest predictor for females ($r = .37$), with higher scores relating to greater progression through the stages from pre-contemplation through maintenance. The magnitude of these correlations is comparable to the relationships seen between social support for exercise and participation in physical activity in this study, supporting a relationship between friend support for exercise and participation in moderate to vigorous intensity exercise. A study of peer effects on weight and behavior followed randomly selected roommates from the beginning to the end of their freshman year.²⁰ Similar to the present study, weight and height prior to beginning college were collected through self-report, along with questionnaires concerning dietary and exercise habits. These measures were repeated in a survey one week after the end of the semester. Students were 28% more likely to engage in regular exercise if their roommate had been exercising prior to beginning college. An important distinction between this study and the present investigation is that while we measured perceived support for physical activity, Yakusheva et al. considered peer influence as an exposure variable, suggesting that merely living with an individual who exercises may increase exercise participation.

The present study categorized social support based on the type of support (general vs. behavior specific), and by the source of the support (family vs. friends). A third factor not considered in this study, is nature of the recipient.¹⁵¹ Support for physical activity may have different effects depending on whether the recipient is initially sedentary or already active.

Support may also be solicited or unsolicited. While this study examined global vs. behavior specific support, this support can be further divided into “main” support (support for continuation of already existing physical activity behaviors),¹⁵² intervening support (support for inactive individuals to initiate activity), and buffering support. A limitation of this study was that it was not asked whether subjects were trying to lose weight or trying to change their physical activity behaviors, as this could have changed whether support was main or intervening.

Overall, this study provides evidence that social support for exercise from friends is associated with greater exercise participation in both male and female college freshman. Moreover, male exercise patterns appear to be strongly associated with both family and friend support, while female exercise patterns demonstrated a less significant associations with social support from friends, and no relationship with support from family for exercise. Increasing peer social support for exercise may thus be one means of increasing physical activity in college freshmen.

5.4 SOCIAL SUPPORT AND DIETARY BEHAVIORS

5.4.1 Global Social Support and Dietary Behaviors

The primary dietary habits quantified in this study were sugar-sweetened beverage consumption, fast food consumption, snacking, meal patterning, and alcohol consumption. Global received support demonstrated significant positive correlations with sweetened beverage consumption, snacking, and frequency of alcohol consumption. No relationship was found between fast food consumption and global social support (Table 6).

The positive relationship between sugar-sweetened beverage consumption and global received social support was more robust than correlations with other dietary variables. This may be important as sugar sweetened beverage consumption is prevalent in college students and can be a large source of empty calories¹⁵³. An anonymous survey of 265 undergraduate college students found that 65% of students consumed sugar-sweetened beverages on a daily basis, and 95% reported consumption in the past month.¹⁵³ Soda was the most common beverage reported. These drinks contributed significantly to student caloric intake, with white students consuming an estimated 397 ± 396 kcal/d from sugar-sweetened beverages, and black students consuming 796 ± 941 kcal/day from these drinks.

Supporting the finding of the present investigation, in a sample of 550 vocational high-school hospitality students, individuals with higher levels of social support consumed greater amounts of sugar-sweetened beverages. Given that peer consumption of sugar-sweetened beverages is linked to personal consumption,¹⁵⁴ it could be that greater social integration or general social support provide more opportunities for consumption of these drinks. Moreover, exposure to situations in which peers are consuming these beverages may alter students' perceptions of normal or acceptable consumption.¹⁵⁵ The results of the present study suggest that global received social support does not have a beneficial influence on sugar-sweetened beverage consumption, and male students' consumption habits may be more susceptible to peer influence.

Snacking was associated with global received social support in the total sample and in males, and this relationship appeared to be driven by evening snacking. Students with more frequent social interactions may have great exposure to the snacking habits of their peers. A nationally representative sample found small but significant relationships between personal snacking behavior and snacking behavior of the individual's nominated closest friend.¹⁵⁶ Higher

snacking frequency has been linked to greater total energy intake and higher BMI in college students.¹⁵⁷ The correlation between social support and snacking should be interpreted with caution, as the nutrient quality and energy density of these snacks were not assessed. However, it does appear that more frequent social contact could be associated with more frequent opportunities to eat, or to be influenced by others' eating habits. Future research should elucidate ways to improve dietary choices in social situations, or to structure social events around activities rather than food.

Alcohol consumption was positively associated with global received social support in the entire sample and in females. This positive associate is in contrast to a study that found more frequent social interaction and higher social integration to be associated with less frequent alcohol consumption.¹⁵⁸ The relationship may depend on the behaviors of friends within the individual's social network.¹⁵⁹ A recent survey of university students found that beliefs about the alcohol consumption of close friends mediated the relationship between campus norms and individual alcohol consumption, and explained 52-62% of the variance mediated. Interestingly, while social support was related to both more frequent alcohol consumption and more drinks consumed on average when drinking in females, general support was associated with fewer drinks consumed when drinking in males. To help explain this difference, future studies should examine social contexts for drinking, as well as reasons for drinking in college males and females. Overall, global received social support appears to be moderately associated with selected unhealthful eating habits.

5.4.2 Social Support for Healthy Eating and Dietary Behaviors

In the total sample, only family support for healthy eating was significantly associated with any of the measured dietary behaviors (Table 7). Higher family support for healthy eating was associated with lower continuous unplanned eating frequency, but the correlation was small ($\rho = -.22$, $p = .030$). The relationship between family support for healthy eating and less continuous unplanned eating seen in the total sample was significant in males, but not in females. Previous research in a sample of women with recent gestational diabetes mellitus found that higher social support for diet from both friends and family was associated with better diet quality as measured by the Healthy Dietary Index, but the association only trended toward significance.¹⁶⁰ This study used the same Sallis Social Support and Eating Survey used in the present study, but measured overall dietary quality using the Healthy Dietary Index rather than the specific behaviors measured in the current study. No studies were found to compare the association between family support for healthy eating and overeating behavior in males, though this relationship appears to be intuitive.

In females, greater friend support for healthy eating was associated with lower sweetened beverage consumption. This finding is consistent with a qualitative study that reported freshman women felt their friends played a large role in their regular dietary choices.⁶² Similarly, Yakusheva et al.²⁰ found that freshman women's dietary habits were significantly influenced by the same pre-college habits of their randomly selected roommate. Specifically, those who roomed with a woman who had a history of restricting their food intake were 22% more likely to opt-out of the unlimited meal plan. Also, those with roommates who used weight-loss supplements prior to college were 18% more likely to use these products themselves during freshman year. While these studies were not specific to sweetened beverage consumption, this

behavior may serve as a proxy for overall attempts to consume a healthy diet and thus appears to be in line with other studies finding relationships between support for healthy eating behaviors and engagement in dietary behaviors these students perceive to be health-promoting.

With regard to meal patterning frequency, only breakfast consumption in males demonstrated a relationship with social support. Family support for healthy eating behaviors demonstrated a highly significant association with breakfast consumption in males. While this relationship is logical, the value of breakfast consumption for weight management has been questioned by previous research. Wengreen & Mancur followed 186 college freshmen from the beginning to the end of their first semester of college.²⁴ Those who gained greater than 5% of their initial body weight were more likely to eat breakfast regularly. In contrast, the National Longitudinal Study of Adolescent Health found that breakfast consumption decreased significantly in 11-21 year olds over a 5-year period, and that fewer days of breakfast consumption was associated with increased z-BMI at follow-up.¹⁶¹ The relationship appears to be clearer in those maintaining large weight losses.¹⁶² A cross-sectional study of the National Weight-Control Registry found that 78% of individuals maintaining a 13.6 kg (30 lbs) weight loss for at least one year regularly ate breakfast. Only 4% of these individuals reported never eating breakfast. The results of the present study suggest that the family is influential in the breakfast habits of college males, though the practical implication of this habit is unclear.

5.5 THEORETICAL PATHWAY

Two pathways were initially hypothesized by which social support could influence BMI and weight related behaviors. The first suggested that global social support, measured by either the

perception of a solid support network or by quantification of instances in which acts of social support are received, could influence dietary and exercise behaviors mediated by the influence of social support on depression and loneliness. While all measures of social support were negatively correlated with loneliness (Table 10), loneliness was not significantly associated with BMI, change in BMI, physical activity, or dietary habits (Table 11). Thus, loneliness does not mediate the relationship between social support and primary outcome measures. Similarly, depressive symptomatology was negatively associated with global social support, family support for exercise and family support for diet. Also similar to loneliness, depressive symptomatology was not significantly associated with any of the primary outcome measures.

A second pathway was proposed in which social support specifically for exercise would influence exercise behavior, while social support specifically for healthy eating habits would influence dietary behavior. It was hypothesized that these variables would influence weight and weight change. As hypothesized, social support for exercise from friends was significantly associated with both total exercise, and moderate to vigorous intensity exercise excluding walking. Social support for healthy eating from friends was not clearly associated with healthy dietary habits; however, family support for eating was associated in with lower disinhibited eating, and more frequent breakfast consumption.

5.6 OVERWEIGHT AND OBESE SUBJECTS

The positive associations found between both global received social support and diet specific social support and BMI as well as the absence of any relationship between social support and change in BMI contradict a consistent relationship between social support and weight loss in

previous studies.^{44-46,54} However, this study examined a sample of college students that were not necessarily attempting to lose weight. The majority (69%) of the participants in this sample were normal weight. These individuals are likely not trying to lose weight, and weight gain may not be a negative outcome in all of these subjects. The result may be a lack of concern for health behaviors and oblivion with respect to support for such behaviors. For example, one study found that non-overweight students reported significantly greater sugar-sweetened beverage consumption than did overweight students.¹⁶³ Sixty-nine percent of these overweight students reported having recently decreased their sweetened beverage consumption. This suggests that sweetened beverage consumption may be of greater concern to overweight students, and of little concern to normal weight students. This may help to explain the positive relationship between social support for healthy dietary behaviors and BMI (which remained statistically significant when overweight and obese individuals were removed from the analysis), as healthy weight individuals may not perceive support for healthy eating behaviors if they are at a healthy weight and do not perceive a need to change these behaviors.

As an exploratory analysis, overweight and obese students were analyzed separately to determine whether relationships were different when normal weight individuals were excluded. Global social support (received) was associated with less weight gain or greater weight loss in overweight and obese individuals (Table 12). The directional nature of the relationships of every other measure of support and BMI became negative when only overweight and obese subjects were analyzed suggesting higher levels of support were associated with less weight gain or weight loss. While these relationships were not statistically significant, a loss of power due to the small sample may have limited our capability to reach significance. Social support may

therefore have a more beneficial influence on weight change in overweight and obese individuals than in healthy weight students.

5.7 STRENGTHS

The primary strengths of this study were the ability to compare general social support to social support specifically for weight related behaviors, equal recruitment of males and females, and the novel investigation of the role of social support in weight and weight related behaviors at a critical point in life. The assessment of multiple types of support allowed this study to determine that while support for exercise may be important for engagement in physical activity during freshman year, support for healthy eating habits does not have a clearly beneficial relationship with actual eating habits. Furthermore, this allowed for the comparison of general support, which not associated with weight change in the total sample but associated with less weight gain in overweight and obese individuals, to behavior specific support.

5.8 LIMITATIONS AND FUTURE DIRECTIONS

This investigation was limited by several factors: 1) Baseline weight was self-reported. 2) The sample was predominantly normal weight with little variation. 3) Subjects were not asked whether they were trying to lose weight, diet, or increase their physical activity. 4) The weight-status, physical activity and dietary behaviors of subjects' friends were not assessed. 5) The study used a cross-sectional design, which did not allow for the determination of causality.

- 1) Weight change was calculated using objective measures of height and weight during the second semester and self-reported height and weight just prior to beginning college. As subjects were asked to recall these measures from approximately 6 months prior to the assessment, this method undoubtedly introduced error into the change in BMI outcome data. Future studies should capture objectively measured height and weight during the first several weeks of college, and again during second semester.
- 2) Sixty-nine of 100 subjects were a healthy weight at the time of the measurement. While the average weight gain of 1.3 kg was similar to average weight gains reported in other studies,^{24,36} The sample may have been biased by the weight-related content of the recruitment flyers (participants knew they would be weighed during the assessment). Moreover, results observed in the overweight and obese subjects were limited in power by the small sample size. While analysis of overweight and obese subjects was not a primary aim of this investigation, the results of this exploratory analysis warrant further investigation.
- 3) Subjects in this study were not asked whether they were trying to lose weight, or whether they were consciously trying to change their physical activity and eating habits. The Sallis Social Support for Exercise and Diet Survey items were developed from interviews with individuals who were consciously trying to make health-behavior changes.¹³⁶ While these items were modified slightly, those not attempting to change these behaviors could be oblivious to support. Future studies should include an item that allows participants to be divided into those attempting to lose weight, and those not attempting to lose weight.

Alternatively, future research may alleviate this confounder by intentionally recruiting only overweight and obese students.

- 4) Previous research has demonstrated that descriptive norm, or an individual's perception of the behaviors of his or her peers, predicts participation in strenuous exercise independent of social support.¹⁶⁴ Furthermore, a review of 16 studies found that bodyweight was significantly influenced by peer-group bodyweight.¹⁶⁵ Another study examined pedometer data in 318 females aged 15-18 and found that physical activity level was partially explained by the physical activity level of the individual's self-selected closest friend enrolled in the study.¹⁶⁶ The current investigation did not assess friends' weight status or level of physical activity. These qualities may have exerted a strong social influence not captured by social support scales. Future studies should include a measure of peer-group norms. As perceived norms are often more powerful than actual behaviors,¹⁰⁹ this data could be collected without recruiting the actual peer-group members. To understand this type of peer influence, future studies should include questions regarding the exercise and diet behaviors of their closest friends, as well as whether they perceive their friends to be underweight, healthy, or overweight.
- 5) The cross-sectional design of this study did not allow for a definitive causal pathway to be determined. The findings of this study suggest that global social support may have a beneficial impact on weight changes during freshman year of college in overweight and obese individuals. This finding warrants further exploration involving objective

measures both prior to beginning college and at the end of freshman year, as well as equal recruitment of overweight and obese students.

5.9 CONCLUSION

College students are particularly susceptible to weight gain, and the eating and exercise habits formed during this time tend to track into adulthood. Social support has been associated with better weight loss outcomes, increased exercise participation, and improvements in dietary habits in intervention studies, as well as improved affect and quality of life in cross-sectional studies. Students transitioning from high school to college often face drastic changes to their social support networks; however, no studies to date had examined the role of both global social support and social support specific to diet and exercise behaviors as they relate to weight changes during this time. Findings from the current study suggest that while social support is not associated with changes in BMI in the general college population, greater social support from friends for exercise is associated with greater total minutes of exercise per week. While exploratory in nature, we found that higher global received social support to be associated with weight loss or lesser weight gain in students who are overweight and obese. Future studies should seek to manipulate diet and exercise-specific social support to determine whether increasing social support in overweight and obese college students can result in greater exercise participation, healthy eating behaviors, and ultimately weight loss or the prevention of weight gain during freshman year.

APPENDIX A: SOCIAL PROVISIONS SCALE

The Social Provisions Scale

Instructions

In answering the next set of questions I am going to ask you, I want you to think about your current relationship with friends, family members, coworkers, community members, and so on. Please tell me to what extent you agree that each statement describes your current relationships with other people. Use the following scale to give me your opinion. (Hand a response card.) So, for example, if you feel a statement is very true of your current relationships, you would tell me “strongly agree”. If you feel a statement clearly does not describe your relationships, you would respond “strongly disagree”. Do you have any questions?

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

1. There are people I can depend on to help me if I really need it. _____
2. I feel that I do not have close personal relationships with other people. _____
3. There is no one I can turn to for guidance in times of stress. _____
4. There are people who depend on me for help. _____
5. There are people who enjoy the same social activities I do. _____
6. Other people do not view me as competent. _____
7. I feel personally responsible for the well-being of another person. _____
8. I feel part of a group of people who share my attitudes and beliefs. _____
9. I do not think other people respect my skills and abilities. _____
10. If something went wrong, no one would come to my assistance. _____
11. I have close relationships that provide me with a sense of emotional security
and well-being. _____
12. There is someone I could talk to about important decisions in my life. _____
13. I have relationships where my competence and skills are recognized. _____
14. There is no one who shares my interests and concerns. _____
15. There is no one who really relies on me for their well-being. _____
16. There is a trustworthy person I could turn to for advice if I were having
problems. _____

APPENDIX B: INVENTORY OF SOCIALLY SUPPORTIVE BEHAVIORS

Rate the frequency of events by circling the appropriate number, using the following categories:

1=Not at all 2=Once or twice 3=About once a week 4=Several times a week 5=About every day

- | | | | | | |
|--|---|---|---|---|---|
| 1. Looked after a family member when you were away. | 1 | 2 | 3 | 4 | 5 |
| 2. Was right there with you (physically) in a stressful situation. | 1 | 2 | 3 | 4 | 5 |
| 3. Provided you with a place where you could get away for awhile. | 1 | 2 | 3 | 4 | 5 |
| 4. Watched after your possessions when you were away
(pets, plants, home, apartment, etc.). | 1 | 2 | 3 | 4 | 5 |
| 5. Told you what she/he did in a situation that was similar to yours. | 1 | 2 | 3 | 4 | 5 |
| 6. Did some activity together to help you get your mind off of things. | 1 | 2 | 3 | 4 | 5 |
| 7. Talked with you about some interests of yours. | 1 | 2 | 3 | 4 | 5 |
| 8. Let you know that you did something well. | 1 | 2 | 3 | 4 | 5 |
| 9. Went with you to someone who could take action. | 1 | 2 | 3 | 4 | 5 |
| 10. Told you that you are OK just the way you are. | 1 | 2 | 3 | 4 | 5 |
| 11. Told you that she/he would keep the things
that you talk about private-just between the two of you. | 1 | 2 | 3 | 4 | 5 |
| 12. Assisted you in setting a goal for yourself. | 1 | 2 | 3 | 4 | 5 |
| 13. Made it clear what was expected of you. | 1 | 2 | 3 | 4 | 5 |
| 14. Expressed esteem or respect for a competency
or personal quality of yours. | 1 | 2 | 3 | 4 | 5 |
| 15. Gave you some information on how to do something. | 1 | 2 | 3 | 4 | 5 |
| 16. Suggested some action that you should take. | 1 | 2 | 3 | 4 | 5 |

17. Gave you over \$25.	1	2	3	4	5
18. Comforted you by showing you some physical affection.	1	2	3	4	5
19. Gave you some information to help you understand a situation you were in.	1	2	3	4	5
20. Provided you with some transportation.	1	2	3	4	5
21. Checked back with you to see if you followed the advice you were given.	1	2	3	4	5
22. Gave you under \$25.	1	2	3	4	5
23. Helped you understand why you didn't do something well.	1	2	3	4	5
24. Listened to you talk about your private feelings.	1	2	3	4	5
25. Loaned or gave you something (a physical object other than money) that you needed.	1	2	3	4	5
26. Agreed that what you wanted to do was right.	1	2	3	4	5
27. Said things that made your situation clearer and easier to understand.	1	2	3	4	5
28. Told you how he/she felt in a situation that was similar to yours.	1	2	3	4	5
29. Let you know that he/she will always be around if you need assistance.	1	2	3	4	5
30. Expressed interest and concern in your well-being.	1	2	3	4	5
31. Told you that she/he feels very close to you.	1	2	3	4	5
32. Told you who you should see for assistance.	1	2	3	4	5
33. Told you what to expect in a situation that was about to happen.	1	2	3	4	5
34. Loaned you over \$25	1	2	3	4	5

APPENDIX C: SOCIAL SUPPORT AND EATING HABITS SURVEY

Social Support and Eating Habits Survey

The following questionnaire deals with social support. Please rate each statement with regard to **your first semester of college**. Please rate each question *twice*. Under *family*, rate how often anyone living in your household has said or done what is described during the your first semester of college. Under *friends*, rate how often your friends, acquaintances, or coworkers have done what is described during the fall semester.

Please write *one* number from the following rating scale in each space:

SAMPLE:

A. If my family *rarely makes fun of the foods I eat*, and my friends *very often do*, I would answer like this:

Family

Friends

A. Made fun of the foods I eat

A. 2

A. 5

None	Rarely	A few Times	Often	Very Often	Does Not Apply
1	2	3	4	5	8

During the past three months, my family (or members of my household) or friends:

	Family	Friends
1. Encouraged me not to eat "unhealthy foods" when I'm tempted.	_____	_____
2. Discussed my eating habits with me.	_____	_____
3. Reminded me to eat "healthy" foods	_____	_____
4. Noticed or commented when I change my eating habits.	_____	_____
5. Noticed of commented when I eat unhealthy foods.	_____	_____
6. Ate unhealthy foods in front of me.	_____	_____
7. Refused to eat healthy foods when eating with me.	_____	_____
8. Brought unhealthy foods to my home or dorm.	_____	_____
9. Got angry when I encouraged them to eat healthy foods.	_____	_____
10. Offered me unhealthy foods.	_____	_____

APPENDIX D: SOCIAL SUPPORT AND EXERCISE SURVEY

Social Support and Exercise Survey

The following questionnaire deals with social support. Please rate each statement with regard to **your first semester of college**. Please rate each question *twice*. Under *family*, rate how often anyone living in your household has said or done what is described during the your first semester of college. Under *friends*, rate how often your friends, acquaintances, or coworkers have done what is described during the fall semester..

Please write *one* number from the following rating scale in each space:

None	Rarely	A few Times	Often	Very Often	Does Not Apply
1	2	3	4	5	8

During the past three months, my family (or members of my household) or friends:

	Family	Friends
11. Exercised with me.	_____	_____
12. Offered to exercise with me.	_____	_____
13. Gave me helpful reminders to exercise ("Are you going to exercise tonight.	_____	_____
14. Gave me encouragement to stick with my exercise program or to begin an exercise program.	_____	_____
15. Changed their schedule so we could exercise together.	_____	_____
16. Discussed exercise with me.	_____	_____
17. Complained about the time I spend exercising.	_____	_____
18. Criticized or made fun of me for exercising.	_____	_____
19. Gave me rewards for exercising (bought me something or gave me something I like.	_____	_____
20. Planned for exercise on recreational outings.	_____	_____
21 Helped plan activities around my exercise.	_____	_____
22. Asked me for ideas on how <i>they</i> can get more exercise.	_____	_____
23. Talked about how much they like to exercise.	_____	_____

APPENDIX E: EARLY TRIALS EATING BEHAVIORS QUESTIONNAIRE

I. Sugar-Sweetened Beverage Consumption

1. Over the past 30 days, how often did you drink soda or pop?

- ☐ NEVER (**Go to question 10**)
- ☐ 1 time per month or less
- ☐ 2–3 times per month
- ☐ 1–2 times per week
- ☐ 3–4 times per week
- ☐ 5–6 times per week
- ☐ 1 time per day
- ☐ 2–3 times per day
- ☐ 4–5 times per day
- ☐ 6 or more times per day

1a. How often were these sodas or pop diet or sugar-free?

- ☐ Almost never or never
- ☐ About $\frac{1}{4}$ of the time
- ☐ About $\frac{1}{2}$ of the time
- ☐ About $\frac{3}{4}$ of the time
- ☐ Almost always or always

2. Over the past 30 days, how often did you drink fruit drinks (such as cranberry cocktail, Hi-C, lemonade, or Kool-Aid, diet or regular)?

- ☐ NEVER (**GO TO QUESTION 11**)
- ☐ 1 time per month or less
- ☐ 2–3 times per month
- ☐ 1–2 times per week
- ☐ 3–4 times per week
- ☐ 5–6 times per week
- ☐ 1 time per day
- ☐ 2–3 times per day
- ☐ 4–5 times per day
- ☐ 6 or more times per day

2a. How often were your fruit drinks diet or sugar-free drinks?

- ☐ Almost never or never
- ☐ About $\frac{1}{4}$ of the time
- ☐ About $\frac{1}{2}$ of the time
- ☐ About $\frac{3}{4}$ of the time
- ☐ Almost always or always

3. Over the past 30 days, how often did you drink sports drinks (such as Propel, PowerAde, or Gatorade)?

- ☐ NEVER
- ☐ 1 time per month or less
- ☐ 2–3 times per month
- ☐ 1–2 times per week
- ☐ 3–4 times per week
- ☐ 5–6 times per week
- ☐ 1 time per day
- ☐ 2–3 times per day
- ☐ 4–5 times per day
- ☐ 6 or more times per day

4. Over the past 30 days, how often did you drink energy drinks (such as Red Bull or Jolt)?

- ☐ NEVER
- ☐ 1 time per month or less
- ☐ 2–3 times per month
- ☐ 1–2 times per week
- ☐ 3–4 times per week
- ☐ 5–6 times per week
- ☐ 1 time per day
- ☐ 2–3 times per day
- ☐ 4–5 times per day
- ☐ 6 or more times per day

II. Eating Away from Home

1. Over the past 30 days, how many times did you buy food at a fast food restaurant, such as McDonald's, Burger King, Arby's, Wendy's, Hardee's, Captain D's, Taco Bell, Taco Johns, Chipotle, KFC, Bojangles', Pizza Hut, Panera, Quiznos (add any local fast food)?

- ☐ Never or rarely
- ☐ 1 time per month
- ☐ 2–3 times per month
- ☐ 1–2 times per week
- ☐ 3–4 times per week
- ☐ 5–6 times per week
- ☐ 1 time per day
- ☐ 2 times per day
- ☐ 3 or more times per day

2. Not including the fast food restaurants listed above, in the past 30 days, how many times did you buy food at any other sit down (full service) restaurant and order from a waiter/waitress?
- ☐ Never or rarely
 - ☐ 1 time per month
 - ☐ 2-3 times per month
 - ☐ 1-2 times per week
 - ☐ 3-4 times per week
 - ☐ 5-6 times per week
 - ☐ 1 time per day
 - ☐ 2 times per day
 - ☐ 3 or more times per day
3. Over the past 30 days, how many times did you buy food from an all-you-can-eat buffet, such as Golden Corral, CiCi's Pizza, Sweet tomatoes', Old Country Buffet, all-you-can-eat café at college or university dining halls, (add any local)?
- ☐ Never or rarely
 - ☐ 1 time per month
 - ☐ 2-3 times per month
 - ☐ 1-2 times per week
 - ☐ 3-4 times per week
 - ☐ 5-6 times per week
 - ☐ 1 time per day
 - ☐ 2 times per day
 - ☐ 3 or more times per day
4. Over the past week, how many times did you eat the following meals that were prepared in your home or in the place where you live? (Fill in the number of days for each meal)
- Breakfast _____ days per week
- Lunch _____ days per week
- Dinner _____ days per week

III. Weight Management Practices

1. Over the past 30 days, have you done any of the following things in order to lose weight or to keep from gaining weight (Check all that apply)?

- ☐ Fasted
- ☐ Ate very little food
- ☐ Took diet pills
- ☐ Made myself vomit (throw up)
- ☐ Used laxatives
- ☐ Used diuretics
- ☐ Used food substitutes (Powder/special drinks)
- ☐ Skipped meals
- ☐ Smoked cigarettes
- ☐ None of the above

2. How often do you weigh yourself? (Check **ONE** response.)

- ☐ Never
- ☐ Once a year or less
- ☐ Every couple of months
- ☐ About once a month
- ☐ About once a week
- ☐ About once a day
- ☐ More than once a day

3. Do you have access to a bathroom scale at home?

- ☐ Yes
- ☐ No

IV. Daily Meal Patterns

In a typical week, how many times do you...

	0 times	1-2 times	3-4 times	5-6 times	7 times
Eat breakfast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eat a mid-morning snack	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eat lunch	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eat a mid-afternoon snack?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eat dinner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eat an evening snack	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eat within an hour of bedtime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1. In the past 6 months were there times when you ate continuously during the day or parts of the day without planning what and how much you would eat?

- ☐ Never or rarely
- ☐ 1 time per month
- ☐ 2-3 times per month
- ☐ 1-2 times per week
- ☐ 3-4 times per week
- ☐ 5-6 times per week
- ☐ 1 time per day
- ☐ 2 times per day
- ☐ 3 or more times per day

V. Alcohol

1. During the past 30 days, have you had at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor? (One drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor.)

- a. Yes
- b. No [Stop and do not respond to additional questions]

2. During the past 30 days, how many days did you have at least one drink of any alcoholic beverage?

_____ Days in past 30 days

- a. No drinks in past 30 days [Skip to next section]

3. During the past 30 days, on the days when you drank, about how many drinks did you drink on average? **NOTE: A 40-ounce beer would count as 3 drinks, or a cocktail drink with 2 shots would count as 2 drinks.**

_____ Number of drinks per day

4. Considering all types of alcoholic beverages, how many times during the past 30 days did you have 4 or more drinks (for women) or 5 or more drinks (for males)

_____ Number of times

- a. None

APPENDIX F: SMOKING QUESTIONNAIRE

SMOKING QUESTIONNAIRE

1. Do you now smoke cigarettes every day, some days, or not at all?
 - ☐ Every day
 - ☐ Some days
 - ☐ Not at all (SKIP to QUESTION 3)

2. On average, how many cigarettes do you smoke each day?
 - ☐ 1 cigarette or less per day
 - ☐ 2 to 5 cigarettes per day
 - ☐ 6 to 10 cigarettes per day
 - ☐ 11 to 20 cigarettes per day
 - ☐ More than 20 cigarettes per day

3. Since you started college have you stopped smoking for one day or longer because you were trying to quit smoking?
 - a. I did not smoke prior to starting college and I still do not smoke (STOP and do not answer Question 4)
 - b. NO, I smoked prior to starting college and I have not attempted to quit smoking since starting college (STOP and do not answer Question 4)
 - c. YES, I have attempted to quit smoking since starting college (Answer Question 4)

4. How long has it been since you last smoked cigarettes regularly?
 - a. Within the past month (less than 1 month ago)
 - b. I stopped smoking sometime during my second semester in college
 - c. I stopped smoking sometime during my first semester in college

APPENDIX G: EARLY TRIAL SEDENTARY BEHAVIOR QUESTIONNAIRE

Sedentary Behavior Questionnaire

Patient ID: _____

Date of Evaluation: ____ / ____ / ____

Protocol Timepoint (see codes): _____

SECTION I: WEEKDAY

On a typical weekday, how much time do you spend (from when you wake up until you go to bed) doing the following? Please check one answer per question.

	None	15 min. or less	30 min.	1 hour	2 hours	3 hours	4 hours	5 hours	6 hours or more
1. Sitting while watching television (including videos on VCR/DVD)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Sitting at work/school doing computer work (email, word or data processing, web-based applications, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Sitting while using the computer for non-work / non-school activities or playing video games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Sitting at work / school doing non-computer office / school work or paperwork	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Sitting while doing non-computer office work or paperwork <u>not</u> related to your job / school (paying bills, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Sitting listening to music, reading a book or magazine, or doing arts and crafts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Sitting and talking on the phone or texting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Sitting in a car, bus, train, or other mode of transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sedentary Behavior Questionnaire

Patient ID: _____

Date of Evaluation: ____ / ____ / ____

Protocol Timepoint (see codes): _____

SECTION II: WEEKEND DAY

On a typical *weekend day*, how much time do you spend (from when you wake up until you go to bed) doing the following? Please check one answer per question.

		15 min. None or less	30 min.	1 hour	2 hours	3 hours	4 hours	5 hours	6 hours or more
1. Sitting while watching television (including videos on VCR/DVD)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Sitting at work/school doing computer work (email, word or data processing, web-based applications, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Sitting while using the computer for non-work / non-school activities or playing video games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Sitting at work / school doing non-computer office / school work or paperwork	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Sitting while doing non-computer office work or paperwork <u>not</u> related to your job / school (paying bills, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Sitting listening to music, reading a book or magazine, or doing arts and crafts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Sitting and talking on the phone or texting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Sitting in a car, bus, train, or other mode of transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX H: REVISED UCLA LONELINESS SCALE

R-UCLA Loneliness Scale

Directions: Indicate how often you feel the way described in each of the following statements. Circle one number for each.

<i>Statement</i>	<i>Never</i>	<i>Rarely</i>	<i>Sometimes</i>	<i>Often</i>
1. I feel in tune with the people around me. ^b	1	2	3	4
2. I lack companionship.	1	2	3	4
3. There is no one I can turn to.	1	2	3	4
4. I do not feel alone. ^b	1	2	3	4
5. I feel part of a group of friends. ^b	1	2	3	4
6. I have a lot in common with the people around me. ^b	1	2	3	4
7. I am no longer close to anyone.	1	2	3	4
8. My interests and ideas are not shared by those around me.	1	2	3	4
9. I am an outgoing person. ^b	1	2	3	4
10. There are people I feel close to. ^b	1	2	3	4
11. I feel left out.	1	2	3	4
12. My social relationships are superficial.	1	2	3	4
13. No one really knows me well.	1	2	3	4
14. I feel isolated from others.	1	2	3	4
15. I can find companionship when I want it. ^b	1	2	3	4
16. There are people who really understand me. ^b	1	2	3	4
17. I am unhappy being so withdrawn.	1	2	3	4
18. People are around me but not with me.	1	2	3	4
19. There are people I can talk to. ^b	1	2	3	4
20. There are people I can turn to. ^b	1	2	3	4

Three-Item Loneliness Scale

Lead-in and questions are read to respondent.

The next questions are about how you feel about different aspects of your life. For each one, tell me how often you feel that way.

<i>Question</i>	<i>Hardly Ever</i>	<i>Some of the Time</i>	<i>Often</i>
First, how often do you feel that you lack companionship:			
Hardly ever, some of the time, or often?	1	2	3
How often do you feel left out:			
Hardly ever, some of the time, or often?	1	2	3
How often do you feel isolated from others?			
(Is it hardly ever, some of the time, or often?)	1	2	3

NOTE: For both scales, the score is the sum of all items.

a. Russell, Peplau, and Cutrona (1980).

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b. Item should be reversed before scoring.

APPENDIX I: SOCIAL MEDIA QUESTIONS

The following questions deal with the use of Social Media sites such as Facebook, My Space, Twitter, LinkedIn, etc. Please answer these questions with regard to your social media usage during your first semester of college.

1. Did you use social media during your first semester of college? Yes_____ No_____
(If no, you may stop here)

2. If you answered, “Yes” to Question #1, what social media site do you use most frequently?

If you answered, “Yes” to Question #1, please rate how strongly you agree or disagree with the following statements on a scale of 1-5 as follows:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

3. My interactions on social media influence my dietary choices and/or eating behaviors. _____

4. My interactions on social media influence my exercise habits and/or physical activity. _____

APPENDIX J: SOCIAL SUPPORT AND INDIVIDUAL DIETARY ITEMS

	All Subjects (n=100)		Males (n=50)		Females (n=50)	
	Received	Perceived	Received	Perceived	Received	Perceived
Sodas/m	$\rho=.20^*$ $p=.046$	$\rho=.04$ $p=.704$	$\rho=.16$ $p=.260$	$\rho=.12$ $p=.421$	$\rho=.26$ $p=.069$	$\rho=.02$ $p=.916$
Fruit Drinks/m	$\rho=.25^*$ $p=.013$	$\rho=.10$ $p=.351$	$\rho=.49^*$ $p<.001$	$\rho=.30^*$ $p=.038$	$\rho=-.05$ $p=.720$	$\rho=-.10$ $p=.522$
Sports Drinks/m	$\rho=.24^*$ $p=.013$	$\rho=.16$ $p=.107$	$\rho=.18$ $p=.207$	$\rho=.21$ $p=.148$	$\rho=.40^*$ $p=.008$	$\rho=.22$ $p=.131$
Energy Drinks/m	$\rho=.01$ $p=.330$	$\rho=.16$ $p=.788$	$\rho=.19$ $p=.186$	$\rho=.08$ $p=.594$	$\rho=.01$ $p=.946$	$\rho=-.03$ $p=.833$
Non-Diet Soda/m	$\rho=.15$ $p=.128$	$\rho=-.04$ $p=.703$	$\rho=.12$ $p=.391$	$\rho=.09$ $p=.532$	$\rho=.23$ $p=.102$	$\rho=-.06$ $p=.709$
Non-Diet Fruit Drinks/m	$\rho=.18$ $p=.081$	$\rho=.01$ $p=.911$	$\rho=.35^*$ $p=.012$	$\rho=.15$ $p=.311$	$\rho=-.06$ $p=.692$	$\rho=-.08$ $p=.570$
Total Sweetened Beverages/m	$\rho=.28^*$ $p=.004$	$\rho=.05$ $p=.605$	$\rho=.39^*$ $p=.005$	$\rho=.16$ $p=.278$	$\rho=.20$ $p=.170$	$\rho=-.01$ $p=.968$
Fast Food meals/m	$\rho=.19$ $p=.053$	$\rho=-.07$ $p=.519$	$\rho=.28$ $p=.051$	$\rho=.07$ $p=.650$	$\rho=.11$ $p=.451$	$\rho=-.14$ $p=.322$
Restaurant meals/m	$\rho=.12$ $p=.227$	$\rho=.04$ $p=.719$	$\rho=.15$ $p=.303$	$\rho=.23$ $p=.112$	$\rho=.10$ $p=.484$	$\rho=-.14$ $p=.353$
Buffet meals/m	$\rho=.05$ $p=.591$	$\rho=.05$ $p=.619$	$\rho=.07$ $p=.613$	$\rho=.16$ $p=.263$	$\rho=.05$ $p=.758$	$\rho=-.07$ $p=.624$
Unplanned Continuous Eating	$\rho=.05$ $p=.596$	$\rho=.03$ $p=.779$	$\rho=.15$ $p=.300$	$\rho=.06$ $p=.679$	$\rho=-.02$ $p=.900$	$\rho=-.01$ $p=.969$
Meals prepared in Dorm/w	$\rho=.01$ $p=.951$	$\rho=-.12$ $p=.243$	$\rho=.04$ $p=.795$	$\rho=-.05$ $p=.727$	$\rho=-.03$ $p=.860$	$\rho=-.20$ $p=.175$
Breakfasts/w	$\rho=-.04$ $p=.717$	$\rho=.13$ $p=.221$	$\rho=.05$ $p=.730$	$\rho=.25$ $p=.082$	$\rho=-.17$ $p=.247$	$\rho=-.06$ $p=.698$
Lunches/w	$\rho=-.09$ $p=.389$	$\rho=.09$ $p=.390$	$\rho=-.01$ $p=.941$	$\rho=.06$ $p=.703$	$\rho=-.17$ $p=.247$	$\rho=-.11$ $p=.462$
Dinners/w	$\rho=-.01$ $p=.919$	$\rho=.11$ $p=.283$	$\rho=-.04$ $p=.811$	$\rho=.14$ $p=.351$	$\rho=-.00$ $p=.984$	$\rho=.02$ $p=.879$
Morning Snacks/w	$\rho=.18$ $p=.069$	$\rho=-.06$ $p=.538$	$\rho=.18$ $p=.219$	$\rho=-.12$ $p=.405$	$\rho=.19$ $p=.179$	$\rho=.01$ $p=.958$
Afternoon Snacks/w	$\rho=.12$ $p=.241$	$\rho=.16$ $p=.125$	$\rho=.20$ $p=.162$	$\rho=.02$ $p=.892$	$\rho=.02$ $p=.880$	$\rho=.28^*$ $p=.049$
Evening Snacks/w	$\rho=.23^*$ $p=.025$	$\rho=.22^*$ $p=.028$	$\rho=.35^*$ $p=.014$	$\rho=.29^*$ $p=.042$	$\rho=.10$ $p=.507$	$\rho=.16$ $p=.277$
Bedtime Snacks/w	$\rho=.15$ $p=.148$	$\rho=-.03$ $p=.799$	$\rho=.16$ $p=.260$	$\rho=.01$ $p=.951$	$\rho=.14$ $p=.327$	$\rho=-.08$ $p=.596$
Alcohol Consumption	$\rho=.23^*$ $p=.030$	$\rho=.01$ $p=.906$	$\rho=.30$ $p=.052$	$\rho=.14$ $p=.387$	$\rho=.33^*$ $p=.025$	$\rho=.06$ $p=.688$
Drinks/day	$\rho=.01$ $p=.358$	$\rho=-.20$ $p=.065$	$\rho=.03$ $p=.862$	$\rho=-.37^*$ $p=.014$	$\rho=.31^*$ $p=.037$	$\rho=.13$ $p=.410$

Sallis Support Scales	All Subjects (n=100)		Males (n=50)		Females (n=50)	
	Friends	Family	Friends	Family	Friends	Family
Sodas/m	$\rho = -.04$ p=.676	$\rho = -.06$ p=.552	$\rho = -.02$ p=.877	$\rho = -.28$ p=.054	$\rho = -.03$ p=.856	$\rho = .12$ p=.175
Fruit Drinks/m	$\rho = -.02$ p=.839	$\rho = .09$ p=.359	$\rho = .09$ p=.541	$\rho = .19$ p=.191	$\rho = -.05$ p=.717	$\rho = .04$ p=.792
Sports Drinks/m	$\rho = -.16$ p=.117	$\rho = -.05$ p=.594	$\rho = .01$ p=.968	$\rho = -.02$ p=.888	$\rho = -.24$ p=.092	$\rho = -.02$ p=.902
Energy Drinks/m	$\rho = -.12$ p=.230	$\rho = -.11$ p=.229	$\rho = -.07$ p=.622	$\rho = .05$ p=.729	$\rho = -.11$ p=.467	$\rho = -.15$ p=.292
Non-Diet Soda/m	$\rho = -.08$ p=.436	$\rho = -.19$ p=.065	$\rho = -.03$ p=.815	$\rho = -.26$ p=.069	$\rho = -.01$ p=.937	$\rho = -.00$ p=.977
Non-Diet Fruit Drinks/m	$\rho = -.03$ p=.741	$\rho = .08$ p=.456	$\rho = .06$ p=.692	$\rho = .12$ p=.426	$\rho = -.06$ p=.668	$\rho = .08$ p=.595
Total Sweetened Beverages/m	$\rho = -.11$ p=.261	$\rho = -.01$ p=.908	$\rho = .03$ p=.860	$\rho = -.09$ p=.524	$\rho = -.30^*$ p=.032	$\rho = .10$ p=.500
Fast Food meals/m	$\rho = .07$ p=.465	$\rho = .02$ p=.858	$\rho = .03$ p=.858	$\rho = .09$ p=.530	$\rho = .15$ p=.300	$\rho = .04$ p=.846
Restaurant meals/m	$\rho = .14$ p=.158	$\rho = .08$ p=.435	$\rho = .17$ p=.232	$\rho = .14$ p=.336	$\rho = .15$ p=.299	$\rho = .04$ p=.769
Buffet meals/m	$\rho = -.07$ p=.482	$\rho = -.10$ p=.324	$\rho = .13$ p=.357	$\rho = -.19$ p=.180	$\rho = -.20$ p=.154	$\rho = -.06$ p=.696
Unplanned Continuous Eating	$\rho = .02$ p=.874	$\rho = -.22^*$ p=.030	$\rho = -.11$ p=.467	$\rho = -.34^*$ p=.017	$\rho = .09$ p=.544	$\rho = -.11$ p=.436
Meals prepared in Dorm/wk	$\rho = .09$ p=.380	$\rho = .06$ p=.580	$\rho = .21$ p=.142	$\rho = .16$ p=.276	$\rho = -.01$ p=.928	$\rho = -.07$ p=.622
Breakfasts/wk	$\rho = .19$ p=.064	$\rho = .16$ p=.123	$\rho = .24$ p=.100	$\rho = .394^*$ p=.005	$\rho = .12$ p=.420	$\rho = -.10$ p=.471
Lunches/wk	$\rho = -.03$ p=.755	$\rho = .04$ p=.667	$\rho = -.05$ p=.740	$\rho = .15$ p=.313	$\rho = -.03$ p=.859	$\rho = -.06$ p=.685
Dinners/wk	$\rho = .08$ p=.450	$\rho = .12$ p=.280	$\rho = .22$ p=.126	$\rho = .14$ p=.338	$\rho = -.08$ p=.569	$\rho = .05$ p=.740
Morning Snacks/wk	$\rho = .08$ p=.405	$\rho = .04$ p=.696	$\rho = .15$ p=.311	$\rho = .12$ p=.401	$\rho = .07$ p=.638	$\rho = .00$ p=.979
Afternoon Snacks/wk	$\rho = .02$ p=.841	$\rho = .06$ p=.568	$\rho = -.01$ p=.924	$\rho = .19$ p=.189	$\rho = .06$ p=.670	$\rho = -.03$ p=.847
Evening Snacks/wk	$\rho = .05$ p=.655	$\rho = -.01$ p=.896	$\rho = -.04$ p=.760	$\rho = .16$ p=.278	$\rho = .15$ p=.288	$\rho = -.13$ p=.363
Bedtime Snacks/wk	$\rho = -.09$ p=.402	$\rho = -.07$ p=.518	$\rho = -.30^*$ p=.036	$\rho = -.13$ p=.377	$\rho = .10$ p=.486	$\rho = -.04$ p=.766
Alcohol Consumption	$\rho = -.07$ p=.497	$\rho = -.02$ p=.842	$\rho = -.18$ p=.253	$\rho = -.08$ p=.617	$\rho = .18$ p=.225	$\rho = .13$ p=.398
Drinks/day	$\rho = -.10$ p=.349	$\rho = -.09$ p=.382	$\rho = -.05$ p=.748	$\rho = -.07$ p=.653	$\rho = .01$ p=.928	$\rho = .13$ p=.938

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